

Interim Measures (IM) Work Plan (Revision 1.0) Pilot Study SWMU 5 - Coal Tar Storage Area

Bluestone Coke

3500 35th Avenue North

Birmingham, Alabama 35207

USEPA ID No.: ALD 000 828 848

January 27, 2023 | Report Number: E1227332



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January 27, 2023

Bluestone Coke
4200 F.L. Shuttlesworth Drive
Birmingham, Alabama 35207

Attention: Mr. Don Wiggins

Re: **Interim Measures (IM) Work Plan (Revision 1.0)**
Pilot Study SWMU 5 – Coal Tar Storage Area
Bluestone Coke
3500 35th Avenue North
Birmingham, Jefferson County, Alabama 35207
USEPA ID No. ALD 000 828 848
Terracon Project No. E1227332

Dear Mr. Wiggins:

Terracon Consultants, Inc. (Terracon) is pleased to provide this Interim Measures (IM) Work Plan (Revision 1.0), Pilot Study SWMU 5- Coal Tar Storage Area for the above-referenced site. This Work Plan has been prepared in response to the *Interim Measures Work plan (IMWP) Soil and Groundwater SWMU Management Area (SMA) 3 – Coke Manufacturing Area* letter from EPA dated October 11, 2022.

If you should have any questions, please do not hesitate to contact us at (205) 942-1289.

Sincerely,

Terracon

Terrell W. Rippstein, AL-PG
Principal Geologist

Andy Smith, AL-PE
Manager, Environmental Services

Cc: Mr. Don Wiggins – Bluestone Coke
James H. Smith - EPA
ADEM

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List of Acronyms

ADEM.....	Alabama Department of Environmental Management
AMSL	Above Mean Sea Level
CMI	Corrective Measures Implementation
CMS.....	Corrective Measures Study
CW	Containment Well
DQA.....	Data Quality Assessment
DQO	Data Quality Objective
EPA.....	Environmental Protection Agency
CMP	Former Chemical Plant
Gal/min	gallon per minute
GC.....	Gas Chromatograph
IM	Interim Measures
IMWP	Interim Measures Work Plan
ISCO.....	In-situ Chemical Oxidation
LCS.....	Laboratory Control Sample
MCL	Maximum Contaminant Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NTU	Nephelometric Turbidity Units
PAH	Polycyclic Aromatic Hydrocarbon
PARCC.....	Precision, Accuracy, Representativeness, Completeness, and Comparability
PE	Professional Engineer
PG	Professional Geologist
QA.....	Quality Assurance
QC.....	Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RPD	Relative Percent Difference
RSL.....	Regional Screening Level

RSSRegenesis Remediation Services
SVOCSemi-Volatile Organic Compound
SWMUSolid Waste Management Unit
TSOPTerracon Standard Operating Procedures for EPA Brownfields
USEPA.....United States Environmental Protection Agency
VOCVolatile Organic Compound

1.0 Introduction

This Interim Measures (IM) Pilot Study Work Plan (Plan) for SWMU 5 - Coal Tar Storage Drainage System was prepared by Terracon Consultants, Inc. (Terracon) for use at the Bluestone Coke, LLC (Bluestone Coke) facility located at 3500 35th Avenue North in Birmingham, Jefferson County, Alabama (**Figure 1**). The Work Plan was requested by the USEPA in a letter dated October 11, 2022. Project activities will focus on the area around SWMU 5 located in SMA 3 – Coke Manufacturing Plant (CMP).

Based on EPA's letter, this Interim Measures Work Plan will detail plans for monitoring, construction, and implementation of both the in-situ soil treatment and in-situ groundwater treatment as a pilot study for SWMU 5. The in-situ soil source treatment and in-situ groundwater treatment will be implemented as a focused Pilot Study to demonstrate the effectiveness of the remedy prior to public notice as a final remedy by EPA. The pilot study will present the opportunity to study the efficacy of the remedy and adjust the remedy as needed to meet the groundwater protection standards and assist in designing a comprehensive remediation system in the Corrective Measures Implementation Plan (CMI). Should the interim measures implemented prove effective it shall be a component of the final remedy that EPA shall propose in the Statement of Basis for Public Notice and Public Comment. EPA is requesting that Bluestone Coke select an area within SMA 3 that has naphthalene at concentrations in the soil and groundwater that exceed the preliminary cleanup standards (PCS) discussed in the CMS. EPA recommends the pilot study area for the Plan be in the vicinity of SWMU #5 Coal Tar Storage Drain System where the impacts to soil and groundwater exceed the PCS

This Plan will be supplemented by the site-specific health and safety plan (HASP) and Quality Assurance Project Plan (QAPP) dated August 30, 2018, which were previously submitted under separate cover to USEPA.

1.1 Site Name or Sampling Area

The Pilot Study is being conducted at the Bluestone Coke facility in the area known as SWMU 5 - Coal Tar Storage Drainage System which is located within SMA 3.

1.2 Site or Sampling Area Location

The Bluestone Coke facility is located at 3500 35th Avenue North in Birmingham, Alabama.

1.3 Responsible Agency

Terracon will be implementing the IM Workplan for Bluestone Coke. The lead regulatory agency is the USEPA Region 4.

1.4 Project Organization

The *project organizational chart and table* included below illustrates the projected project team for the IM activities. However, subcontractors performing IM field activities (drilling, sampling, and laboratory analysis) may change. Any changes in subcontractors from those illustrated and discussed below will be included in a Plan Addendum. Subsequent sections discuss key personnel roles associated with each project.

Project Organizational Chart

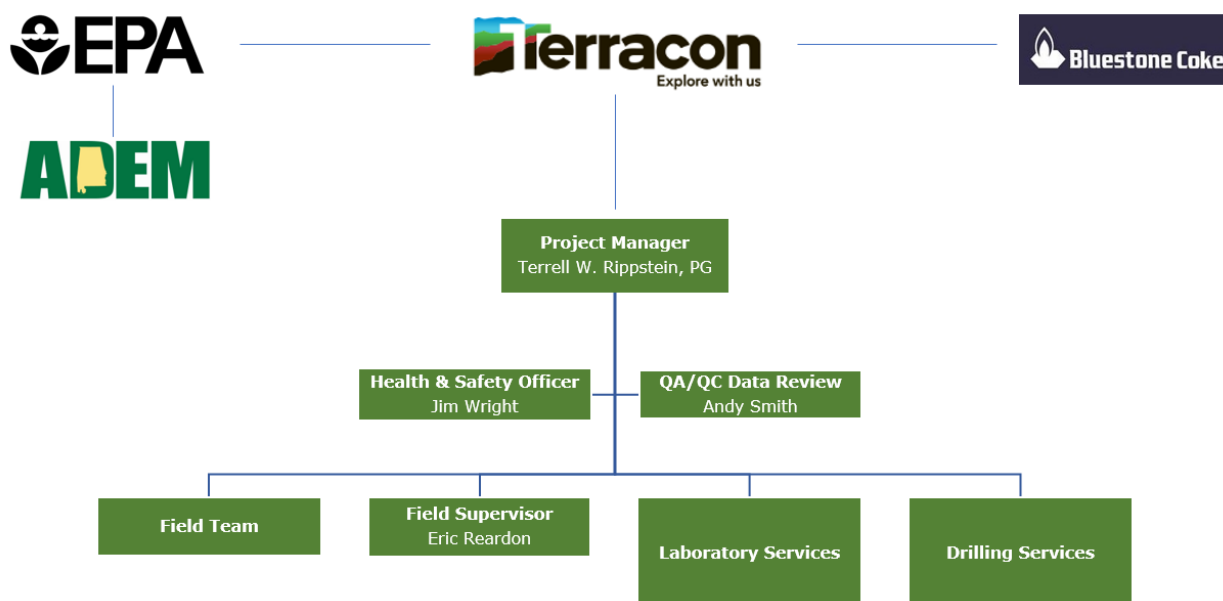


Table 1. Project Organization

Title/Responsibility	Name	Phone Number
USEPA Project Manager	James H. Smith	(770) 853-8318
ADEM	Chief, Engineer Services Section	(334) 271-7700
Bluestone Coke Manager	Don Wiggins	(205) 516-0348
Terracon Project Manager	Terry Rippstein	(205) 443-5244
Quality Assurance Manager	Andy Smith	(205) 443-5249
Field Supervisor	Eric Reardon	(205) 443-5218
Eurofins (Analytical)	Leah Klingensmith	(615) 301-5038
Geolab Drilling	Joe Granthem	(770) 868-5407
Technical Drilling (Drilling)	Detle Lee	(205) 758-7454

Project activities will be organized and conducted in accordance with this Plan. Activities will be performed using various Terracon resources, relevant subcontractor resources, and management guidance and oversight from Bluestone Coke and the USEPA. The local project office for this assessment is the Terracon office in Birmingham, Alabama.

1.4.1 Terracon Project Manager

The Terracon Project Manager provides technical guidance, administration, and resources to direct project QA. A strong working knowledge of state and federal regulatory programs is essential to the position. **Mr. Terrell W. Rippstein, P.G.** fills this role with more than 32 years of relevant experience. Mr. Rippstein draws local resources and staffing primarily from the Terracon office in Birmingham, Alabama. Mr. Rippstein will interact with the USEPA directly as needed. Mr. Rippstein is located less than fifteen miles from the Bluestone Coke facility. His oversight and technical duties beyond this project do not require more than short, regional travel.

1.4.2 QA/QC Reviewer

The QA/QC Reviewer (Terracon) provides documentation audits and technical review to assist in promoting, implementing, and documenting QA compliance. The QA/QC Reviewer is isolated from the implementation chain-of-command. This allows lateral support as a peer to the Project Manager without introducing unintentional biases from conducting the work. The QA/QC Reviewer must have extensive environmental and regulatory assessment experience at both the state and federal levels. **Mr. Andy Smith, P.E.** fills this roll. Mr.

Smith has over twenty years' experience in the environmental field. Mr. Smith is a senior member of the firm with extensive environmental and regulatory assessment and remediation experience.

1.4.3 Site Personnel

Terracon site personnel will have completed the Occupational Safety and Health Administration basic 40-hour health and safety training course, Hazardous Waste Operations and Emergency Response (HAZWOPER), including annual refreshers. Terracon field staff also complete in-house training modules on-line through the *Terracon Learning System* (TLS), an online training system available via live webcasts, recorded webcasts, and self-paced online and offline options. Materials covered include: sample collection protocols, conventional and direct push drilling investigation techniques, decontamination procedures, and IDW management. TLS modules also include a "lessons learned" element designed to familiarize field staff with common problems encountered during field data collection and the appropriate corrective measures as a response to those problems. All training records will be maintained in Terracon's Corporate Headquarters in Olathe, Kansas.

1.5 Statement of the Specific Problem

Bluestone Coke located in Birmingham, Jefferson County, Alabama, has been conducting a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) since 1990 in accordance with the regulations set forth by the RCRA Hazardous and Solid Waste Amendments (HSWA) to evaluate past waste management practices at its Birmingham, Alabama, facility. During the RFI, a groundwater plume was identified in SMA 3 located at the southeastern portion of the facility (Figure 2). Chemicals identified in groundwater beneath SMA 3 at concentrations above their respective maximum contaminant levels (MCLs) include benzene, naphthalene, and several other volatile organic compounds (VOCs), semi-volatile organic Compounds (SVOCs) and metals. Corrective Measures Study (CMS) SMA 3 – CMP (Revision 1.0) was submitted to EPA on October 21, 2021. On October 11, 2022, EPA requested in a letter that a Pilot Test be performed around SWMU 5 in SMA 3 to determine if the corrective measures recommended in the CMS are effective to remediate soil and groundwater. The constituents of concern in SWMU 5 for this Pilot Test are naphthalene and benzene.

2.0 Background

2.1 Site or Sampling Area Description

The Bluestone Coke Facility is located in an industrial area in the northern portion of Birmingham, Alabama. SMA 3 is located in the southwestern portion of the site (Figure 2). SWMU 5 is located in the southeastern portion of SMA 3 are shown on Figure 2.

2.2 Geological Information

The facility is underlain by sedimentary rocks that range in age from Cambrian to Pennsylvanian. The Opossum Valley Fault generally trends northeast to southwest, crossing through the Bluestone Coke property in the northern portion of the facility at the Polishing Pond (SWMU 22). The majority of the Bluestone Coke property lies on the hanging wall fault block to the east of the Opossum Valley Fault. The foot wall of the fault lies to the west and underlies Sand Mountain. The majority of the Bluestone Coke property is underlain by the Conasauga Formation. The Red Mountain Formation, Fort Payne Formation, Tuscumbia Limestone, Hartselle Sandstone, Floyd Shale, and Pottsville Formation outcrop in a small area of the facility on the western side of the fault.

The Conasauga Formation is Cambrian-Aged and typically is medium gray, thin- to medium-bedded limestone. Locally, bedding thickness is reported to range from a few inches to as much as 5 feet or more in the massive sections. Locally, the Conasauga Formation dips to the southeast at 26 to 32 degrees, with a strike of approximately N45°E. An extensive network of faults and joints has developed in the Conasauga Limestone because of thrust faulting. The faults and joints typically trend northeast and northwest. The northeast trending joints (strike of N45°E) dip approximately 60°NW (approximately perpendicular to bedding), while the northwest trending joints strike 300°NW and have subvertical dips. The results of previous investigations indicate that the upper 2 feet of the Conasauga Formation underlying the Bluestone Coke facility are highly weathered. Below the weathered surface, the limestone is generally massive, with few fractures. The limestone is typically hard, with 1- to 2-foot-thick lenses of softer, darker gray shale and shaley limestone. Occasionally, fractures are present, ranging from a few inches to a few feet thick. Fracture zones typically contain limestone rubble that exhibits secondary healing by calcite crystals. Fracture zones typically are encountered in the upper 50 feet of the formation and are less frequent with increasing depth. On the western side of the Opossum Valley Fault (in the SWMU 23 area), outcrops of the Hartselle Sandstone, Tuscumbia Limestone, Fort Payne Chert, Red Mountain Formation, and Pottsville Formation have been mapped. Brief descriptions of these units are provided below:

- Hartselle Sandstone – consists mainly of clean, well-sorted, light-colored, very fine- to medium-grained quartz sand;
- Tusculumbia Limestone – consists of thick-bedded, medium-dark to medium-gray, crystalline, oolitic, sublithographic, and bioclastic limestone with minor amounts of chert;
- Fort Payne Chert – consists of dark-gray sublithographic limestone and dense dark-gray chert;
- Red Mountain Formation – consists of dark-reddish-brown to olive-gray siltstone, sandstone, and shale with hematite beds; and
- Pottsville Formation – consists of alternating beds of sandstone and shale with numerous coal seams and associated underclays.

The topography of the bedrock underlying the Bluestone Coke facility generally slopes to the north toward Five Mile Creek. Top-of-bedrock elevations range from 583.1 feet amsl in the Coke Plant area to 498.6 feet amsl near Five Mile Creek. Weathering of the Conasauga Formation has produced undulations in the surface of the bedrock. Several feet of relief have developed on the bedrock surface. This relief is as much as several tens of feet in some areas of the property; however, karst features are not evident at the ground surface. Where exposed, enlargement of bedding planes and fractures appears to have occurred through solution of the bedrock. Solutionally enlarged fractures and joints primarily are limited to the upper few feet of bedrock and have been observed up to 1 foot wide.

The following text presents the current conceptual hydrogeologic flow mode. The conceptual hydrogeologic flow model is composed of residuum groundwater, shallow bedrock groundwater, and deep bedrock groundwater. Groundwater occurs within the residuum where the water table is higher than the bedrock surface. Groundwater flow through this material occurs in interstitial pore spaces between the clay particles at a low rate due to the relatively low permeability. Flow rates may be higher where a concentration of chert gravels at the bedrock surface has occurred, although based on borehole observations, such occurrence is limited. Within the shallow and deep bedrock aquifers, groundwater migrates along fractures and bedding planes both horizontally and vertically. Within the shallow bedrock aquifer, groundwater flow is primarily horizontal due to the interconnectivity of the fractures. Groundwater within the shallow bedrock discharges to surface water bodies such as the Lafarge and Southern Ready Mix Quarries, surface drainage ditches, and Five Mile Creek. Deep bedrock groundwater probably migrates toward discharge points such as the Lafarge and Southern Ready Mix Quarries. The groundwater flow in the area of Five Mile Creek is east towards Shuttlesworth Drive.

3.0 Pilot Test

The performance objective of this Pilot Study is to determine if in-situ chemical oxidation/reduction is effective in reducing concentrations of naphthalene and benzene in

the soil and groundwater within the study area around SWMU 5. The study area around SWMU 5 is approximately a 125 feet by 125 feet area (Figure 3). We propose the use of PetroFix Remedial Solution (PetroFix) to remediate the dissolved phase petroleum hydrocarbons in SWMU 5. PetroFix is a proprietary unique activate carbon remedial fluid paired with soluble, anaerobic electron acceptors designed to remediate dissolved hydrocarbons. Regeneration Remediation Services (RSS) is the company that produces Petrofix. A PetroFix specification Sheet and RSS Scope of work are provided in Appendix A. In addition, a case study for PetroFix showing it's effectiveness on BTEX, naphthalene, and TPH-GRO concentrations is included in Appendix A.

3.1 Pre- and Post-Injection Soil and Groundwater Sampling

Soil and Groundwater sampling procedures will follow the site specific QAPP (8/30/18) and appropriate EPA Region 4 guidance documents.

3.1.1 Soil Sampling

Prior to the start of the Pilot Test, nine soil borings designated 5-SB005A through 5-SB013A will be drilled (Figure 4). The borings will be installed using either the direct push or the hollow-stem auger drilling method. Soil samples will be collected continuously until bedrock refusal. A portion of each 2-foot soil sample interval will be submitted for Analysis of VOCs by EPA Method 8260 and SVOCs by EPA Method 8270. Approximately 6 months after the injection has been performed, 9 additional borings designated 5-SB005B through 5-SB013B will be installed adjacent to the previously installed borings and soil samples will be collected from the same 2-feet intervals and submitted for laboratory analysis of VOCs and SVOCs. QA/QC samples will be collected as appropriate (see Section 3.1.4). Decontamination procedures are presented in Section 3.2.

3.1.2 Monitoring Well Installation

In addition to the soil borings, a new temporary monitoring well (designated SWMU5-TW1) will be installed downgradient of the study area (Figure 4). This monitoring well will be a Type II monitoring well that is screened in the upper most water bearing unit.

- Prior to intrusive activities, the appropriate utility notifications are to be made and the dates of intrusive activities will be scheduled. Bluestone will provide additional utility clearance for potential private utility clearance or subsurface structures at the proposed boring location. If there is uncertainty associated with potentially unmarked utilities, the Field Team Leader must suspend work until the issue can be resolved.
- Care will be taken to avoid contamination or cross contamination during monitoring well installation. This will be accomplished by decontaminating all drilling tools, rods, rigs, groundwater pumps, surge blocks, or other development tools, between boreholes, during installation activities, and between wells.

- The temporary monitoring well will be constructed in a manner that prevents the introduction or migration of contamination to a water-bearing zone or aquifer through the casing, drill hole, or annular materials.
- Well installation will be performed using a hollow-stem auger or air hammer rig.
- 2-inch diameter PVC screen (0.010 slot), 2-inch diameter PVC well casing, sand filter pack (20 mesh silica sand, bentonite seal, and cement/bentonite grout will be used to construct the monitoring well. Sand will be placed two-foot about the top of the screen and a bentonite seal of at least 2-foot will be placed on top of the sand. Grout will be placed on top of the hydrated bentonite seal to ground surface.
- The surface completion will consist of a protective casing with a locking cover and a water-tight well cap will be installed on the well casing. The protective casing will be installed by pouring a concrete slurry into the borehole to the ground surface and will have a minimum of two ¼-inch weep holes.
- A concrete surface pad will be centered on the well.
- Four protective bollards will be installed around the concrete surface pad.

3.1.3 Water-Level Measurements

All field meters will be calibrated according to manufacturer's guidelines and specifications before and after every day of field use. Field meter probes will be decontaminated before and after use at each well. Decontamination and water level measurement procedures will follow the FBQS (<http://www.epa.gov/region4/sesd/fbqstp/index.html>).

If well heads are accessible, all wells will be sounded for depth to water from top of casing and total well depth prior to purging. An electronic sounder, accurate to the nearest +/- 0.01 feet, will be used to measure depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the top of the water column, the graduated markings on the probe wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. Typically, the measuring device emits a constant tone when the probe is submerged in standing water and most electronic water level sounders have a visual indicator consisting of a small light bulb or diode that turns on when the probe encounters water. Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of the well screen. Total well depths will be measured by lowering the weighted probe to the bottom of the well and recording the depth to the nearest 0.1 feet.

Water-level sounding equipment will be decontaminated before and after use in each well. Water levels will be measured in wells which have the least amount of known contamination first. Wells with known or suspected contamination will be measured last.

3.1.4 Purging

The wells will be purged and sampled using the "low flow method" in accordance with the FBQS found at <http://www.epa.gov/region4/sesd/fbqstp/index.html> using pumps and tubing specified in the FBQS. Clean flexible, disposable, dedicated tubing will be used for

groundwater extraction. Pumps will be placed as described in the FBQS. Field Measurements of pH using a Multi-parameter Sonde will be monitored during purging.

It is most important to obtain a representative sample from the well. Stable water quality parameter (pH and specific conductance) measurements indicate representative sampling is obtainable. Purging will be considered complete if for three consecutive readings:

- pH varies by no more than 0.1 pH units
- specific conductance readings are within 5% of the average; and
- turbidity is less than 10 NTUs.

If the well casing volume is known, measurements will be taken before the start of purging, in the middle of purging, and at the end of purging each casing volume. If water quality parameters are not stable after 5 casing volumes, purging may cease as described in the FBQS, which will be noted in the logbook, and ground water samples will be taken. The depth to water, water quality measurements and purge volumes will be entered in the logbook.

The “Low Flow” purging method will be used. If used the method described in the FBQS will be used and as with the traditional purging method all chemical parameters will be stable, as described above, prior to sampling.

3.1.5 Well Sampling

Once field parameters stabilize and purging is considered complete, the monitoring wells will be sampled via low-flow techniques

At each sampling location, all bottles designated for a particular analysis (e.g., VOCs) will be filled sequentially before bottles designated for the next analysis are filled (e.g., SVOCs). If a duplicate sample is to be collected at this location, all bottles designated for a particular analysis for both sample designations will be filled sequentially before bottles for another analysis are filled. Groundwater samples will be transferred from the pump tap directly into the appropriate sample containers with preservative, if required, chilled if appropriate, and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the tap to the sample container.

Samples for volatile organic compound analyses will be collected as described in the FBQS (<http://www.epa.gov/region4/sesd/fbqstp/index.html>). Vials for volatile organic compound analysis will be filled first to minimize the effect of aeration on the water sample. The test vials will come from the lab with hydrochloric acid (HCl) for preservation. The vials will be filled directly from the pump tap and capped. The vial will be inverted and checked for air bubbles to ensure zero headspace. If a bubble appears, the vial will be discarded and a new sample will be collected.

The monitoring wells which will be used to evaluate the effectiveness of the IM are listed on below.

Well ID	Monitored Unit	Screened Interval (ft bgs)	Depth to Bedrock (ft bgs)
MW-58	SB	19-29	16
MW-59	SB	39.5-49.5	4
MW-74	SB	19-29	16.3
MW-75	SB	39-49	17
SWMU5-TW1*	SB	TBD	TBD

SB = Shallow Bedrock

TBD = To be determined

*new temporary monitoring well (designated SWMU5-TW1)

Groundwater samples will be collected prior to starting the Pilot Test and analyzed for VOCs, SVOCs, pH, dissolved oxygen, oxidation reduction potential, temperature and specific conductivity. After completion of the PetroFix injection, groundwater will be sampled quarterly for a period of one year for the same constituents to determine the effectiveness of the injection. QA/QC samples will be collected as appropriate (See Section 3.1.4).

3.1.6 PostSample Summary

The table below provides a summary of the soil, groundwater, and QA/QC samples to be collected during the Pilot Study. A table of the Method Detection Limits (MDL) and the Reporting Limits (RL) for VOCs and SVOCs in soil and groundwater are included in Appendix B.

Sample Media	Minimum Number of Samples	Analyses (Method)	Rationale
Groundwater	5 shallow bedrock monitoring wells	VOCs (8260B) SVOCs (8270D)	Determine effectiveness of the IM. Pre-injection and quarterly for one year post-injection.

Sample Media	Minimum Number of Samples	Analyses (Method)	Rationale
Soil	18 Soil Borings sampled continuously at 2-foot intervals	VOCs (8260B) SVOCs (8270D)	Determine effectiveness of the IM. Nine borings pre-injection and 9 borings post-injection.
Field blanks	1 per 20 samples or 1 per day of field activities	VOCs (8260B) SVOCs (8270D)	Evaluate the effects of ambient conditions and sample containers on accuracy
Trip Blanks	1 per cooler containing samples for VOC analysis	VOCs (8260B)	Evaluate how shipping and handling procedures are affecting accuracy by introducing contaminants into the samples
Temperature Blanks	1 per cooler	Thermometer	Evaluate sample temperature effects on accuracy
Equipment blanks	1 per 20 samples or 1 per day of field activities	VOCs (8260B) SVOCs (8270D)	Evaluate sample equipment and/or field decontamination effects on accuracy
Duplicate Samples	1 for every 10 samples collected	VOCs (8260B) SVOCs (8270D)	Assess the effects of sample collection technique on sample precision
Matrix spike/matrix spike duplicate	1 per 20 samples or 1 per day of field activities	VOCs (8260B) SVOCs (8270D)	Evaluate the matrix effects on sample precision

Note: For more information on QA/QC samples such as Matrix Spikes or Duplicates. See Section 10.

3.2 Decontamination Procedures

The decontamination procedures that will be followed are in accordance with the EPA Region 4 FBQS (<http://www.epa.gov/region4/sesd/fbqstp/index.html>). Decontamination of sampling equipment must be conducted consistently as to assure the quality of samples collected. All equipment that comes into contact with potentially contaminated soil or water will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment.

The following, to be carried out in sequence, is an USEPA recommended procedure for the decontamination of sampling equipment:

- Non-phosphate detergent and tap water wash, using a brush if necessary
- Tap-water rinse
- Deionized/distilled water rinse
- Deionized/distilled water rinse (twice)

Equipment will be decontaminated in a pre-designated area on pallets or plastic sheeting, and clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered.

3.3 Analytical Laboratory

Laboratory reporting quality will be enhanced through a formalized process and management system applied to ensure data quality within standard method requirements. Laboratory reporting will occur consistent with the laboratory QA Manuals (Appendix D). In addition, laboratory reports will include a final data quality documentation package for all analyses.

A list of information to be supplied with laboratory data deliverables is as follows:

- Standard QC Data Package Provided by the analytical laboratory, with final analytical report with qualifiers (where necessary)
- Chain of Custody Form
- Method Blank
- Matrix Spike/Spike Duplicate Summary (MS/MSD)-with control limits
- Laboratory Control Sample Summary (LCS)-with control limits
- Reporting Limits listed on all reports
- Surrogate Recoveries for GC and GC/MS analyses (on final report)
- Method Detection Limits (MDLs)

After validation of each laboratory package is completed, laboratory results will be summarized in tabular form. The data summary report will include tabular summaries of analytical testing results, laboratory reports, and a summary of data validation conclusions. In addition to the data summary report, data collected during the project will be summarized in the final report.

Laboratory audit and associated corrective action records will be maintained within laboratory QC records. Individual records may be reviewed as determined relevant to ensure QC on a project-by-project basis. Corrective actions taken in response to audit or QC data review findings will be evaluated by the Terracon Project Manager and/or the QA/QC reviewer and discussed in the final report.

3.4 Underground Injection Control Permit

An underground injection control (UIC) permit must be obtained prior to injecting the PetroFix into the subsurface. ERP Coke will apply for a Class V UIC permit from the Alabama Department of Environmental Management (ADEM) within 60 days of approval of this Work Plan. It takes approximately 180 days to receive a UIC permit in Alabama.

3.5 PetroFix Injection

The RSS proposal for injection of the PetroFix is included as Appendix A.

RRS will be equipped with multiple injection tool options to use with 1.5-inch diameter DPT rods. The injection tool string will be advanced to the top or bottom of the target treatment zone and injections will be performed in a bottom up or top-down method depending on the site lithology.

The remediation technologies will be mixed in an injection trailer (Figure 2) with water in batches at the designated solution percentage and kept in constant suspension throughout the injection application. Pressures, flow rates, and total volume will be monitored and digitally documented for each injection interval. Simultaneous injection at multiple locations may be conducted to increase efficiencies on-site. RRS will monitor the injection points and surrounding areas for any signs of surfacing, and a spill response kit will be on standby.

During the application, real-time information will be collected and analyzed to help verify design assumptions and subsurface reagent distribution. Depending on the primary product applied, data collected and analyzed may consist of groundwater quality parameters (i.e., pH, conductivity, DO, ORP, etc.), depth-to-water measurements, visual indicators through groundwater or soil samples, and in-field injection concentration test kits. This information is typically collected during the application when operating within 10 feet of an appropriately screened monitoring well. Based on the information collected, the project team may modify

the remediation design to optimize the injection application further. Typical modifications may include injection concentrations, volume per vertical foot, injection intervals, and point spacing.

Once the injection event is completed, RRS will demobilize all equipment and personnel off-site. A detailed injection summary report which includes injection point data (interval depths, injection pressure/flow rates, reagent volume, time elapsed and if surfacing occurred), field observations and any other noteworthy information, will be prepared.

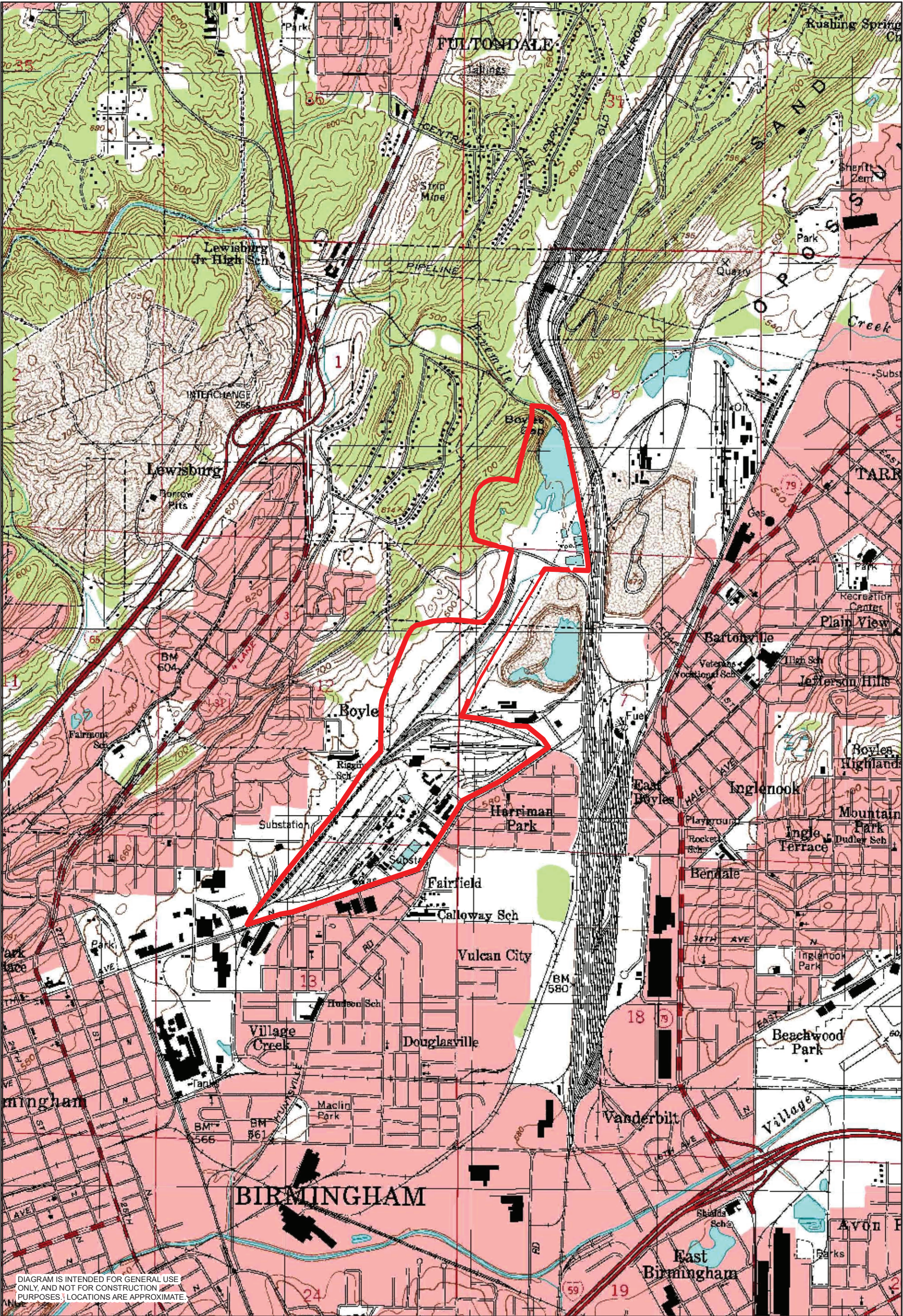
4.0 Field Health and Safety Procedures

Terracon will use the site-specific Health and Safety Plan that has been prepared for the facility and previously submitted to EPA. The HASP was prepared in accordance with the requirements set forth in the Occupational Safety and Health Administration Regulation 29 CFR 1910.120, where applicable, and applicable state, city, or local safety codes. The HASP will be reviewed and signed daily by all field personnel prior to field work indicating that they understand the plan and its requirements. Copies of the plan will be maintained on-site and made available to all personnel throughout the investigation activities. A need for special personal protective equipment (PPE) beyond standard Level D is not anticipated. However, should site conditions warrant, all onsite personnel will withdraw to a pre-designated rally point per the site HASP. Further information regarding health and safety considerations is included in the HASP.

5.0 Implementation Schedule

A Gantt Chart illustrating the implementation schedule for this Work Plan has been prepared and is included in Appendix C.

FIGURES



Legend

Facility Boundary

TOPOGRAPHIC
North Birmingham, AL
7.5 Minute Quadrangle, USGS, 1997



Date: 8/24/2013
PM: TWR
Project: E1137112
Author: 94

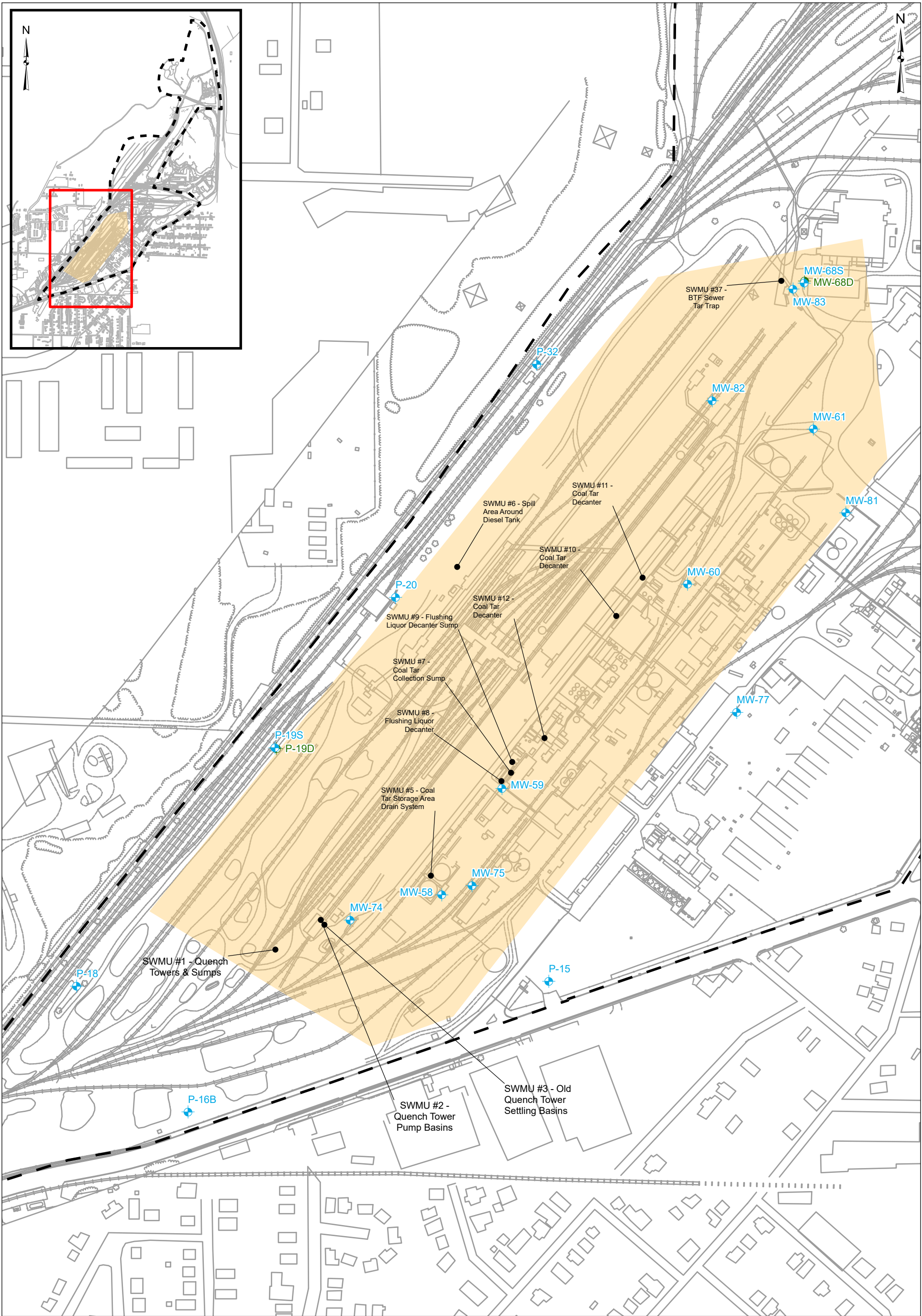


110 12th St. North
Birmingham, Alabama 35203
Phone: (205) 942-1289
Fax: (205) 443-5302

FACILITY LOCATION MAP
Bluestone Coke
3500 35th Avenue North
Birmingham, AL 35207

FIGURE
1





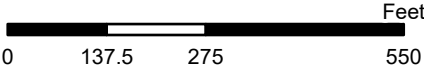
C:\GIS\IE 1197237 - BluestoneCoke\Maps\IE1197237 - BluestoneCoke 2021.aprx

Legend

- Facility Boundary
- SMA - Coke Manufacturing Plant
- Deep Bedrock Monitoring Well
- Shallow Bedrock Monitoring Well
- SWMU

Notes:
1. SWMU - Solid Waste Management Unit
2. Management boundaries are approximate.
3. AOC - Area of Concern.

DATA SOURCES:
ESRI WMS - World Aerial Imagery, OpenStreetMap



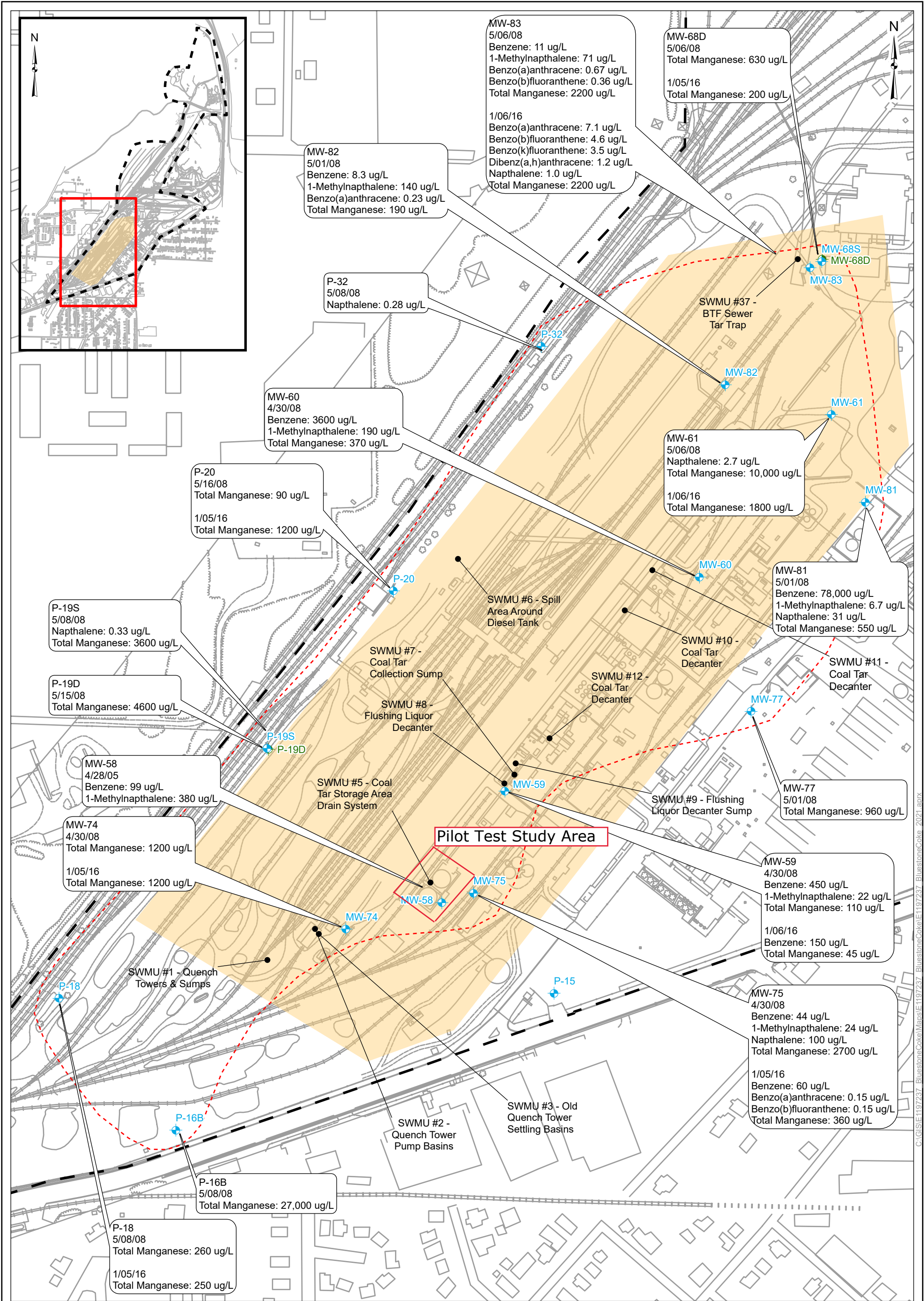
Project No.:	E1137112
Date:	Oct 2021
Drawn By:	EMA
Reviewed By:	TWR



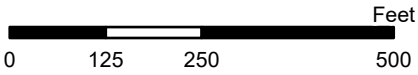
110 12th Street North
Birmingham, AL 35203
PH. (205) 942-1289
terracon.com

Coke Manufacturing Plant Map
Bluestone Coke, Inc. 3500 35th Avenue North Birmingham, Alabama

Figure
2



DATA SOURCES:
ESRI WMS - World Aerial Imagery, OpenStreetMap



Legend

- Facility Boundary
- SMA - Coke Manufacturing Plant
- Deep Bedrock Monitoring Well
- Shallow Bedrock Monitoring Well
- Groundwater Plume > MCL/RSL
- SWMUs

Project No.:	E1137112
Date:	Oct 2021
Drawn By:	EMA
Reviewed By:	TWR

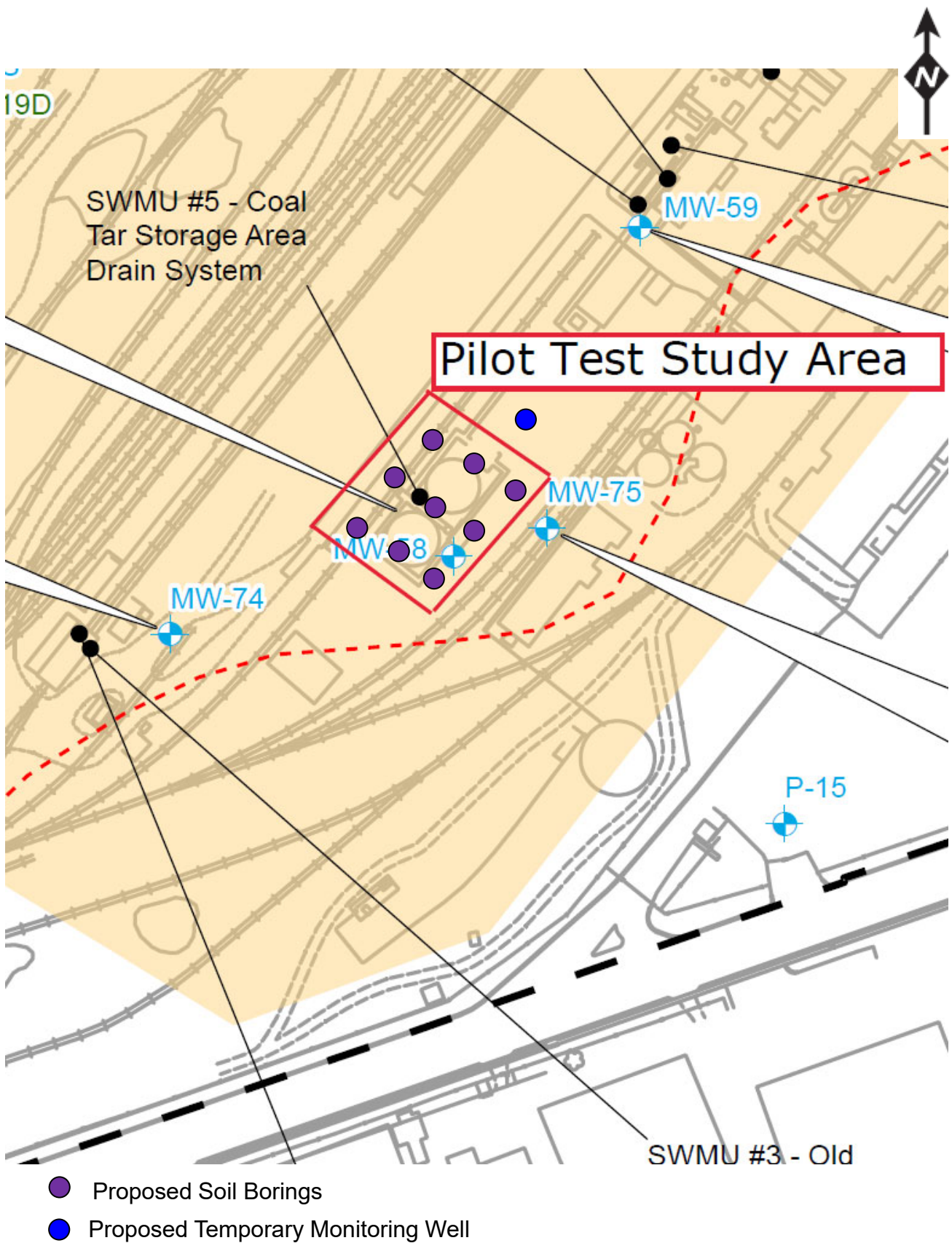
110 12th Street North

Birmingham, AL 35203

PH. (205) 942-1289

terracon.com

Groundwater Concentrations > MCL/RSL	Exhibit
Bluestone Coke, Inc. 3500 35th Avenue North Birmingham, Alabama	3



Project Manager:	TWR
Drawn By:	TWR
Checked By:	TWR
Approved By:	AMS
Project No.	E1227332
Scale:	1"= 125'
File Name:	E1227332
Date:	Dec '22



Study Area
Bluestone Coke 3500 35 th Avenue North Birmingham, Jefferson County, Alabama

Figure
4

APPENDIX A

Regenesis Proposal



REGENESIS

Technology-Based Solutions for the Environment

PROJECT NAME

Bluestone Coke

PREPARED FOR

PREPARED BY

REGENESIS
Owen Miller
omiller@regenesiS.com

Daniel Pile
dpile@regenesiS.com

December 15, 2022

Project Summary

REGENESIS appreciates the opportunity to provide our remedial design and cost estimate for the Bluestone Coke project. This proposal includes an overview of our proposed solution, the project goals, technologies proposed, application design summary table and a treatment area map.

Proposed Solution

We propose the use of [PetroFix](#) Remedial Fluid to remediate dissolved phase petroleum hydrocarbons (PHCs) at your project site. PetroFix is microscale activated carbon solution composed of very small activated carbon (AC) particles (1-2 microns). PetroFix will deposit a thin layer of AC on the aquifer matrix where it will remain as a permanent fixture and remove PHCs out of the dissolved phase. In addition, PetroFix will provide a blend of nitrate and sulfate to facilitate anaerobic bioremediation. Thus, PetroFix remove PHCs in both the short and long term via in-situ sorption and promote destruction of the contaminants via anaerobic bioremediation.

Project Goals

- Impart In-Situ Sorption and Anaerobic Bioremediation treatment
- Reduce source strength
- Prevent further migration of the PHC plume

Design Assumptions

- No NAPL is present in the treatment zone
- Groundwater seepage velocity is <150 ft/yr
- Geochemical conditions are amenable to biodegradation (e.g., pH is near neutral).

Technologies Proposed

- [PetroFix](#)

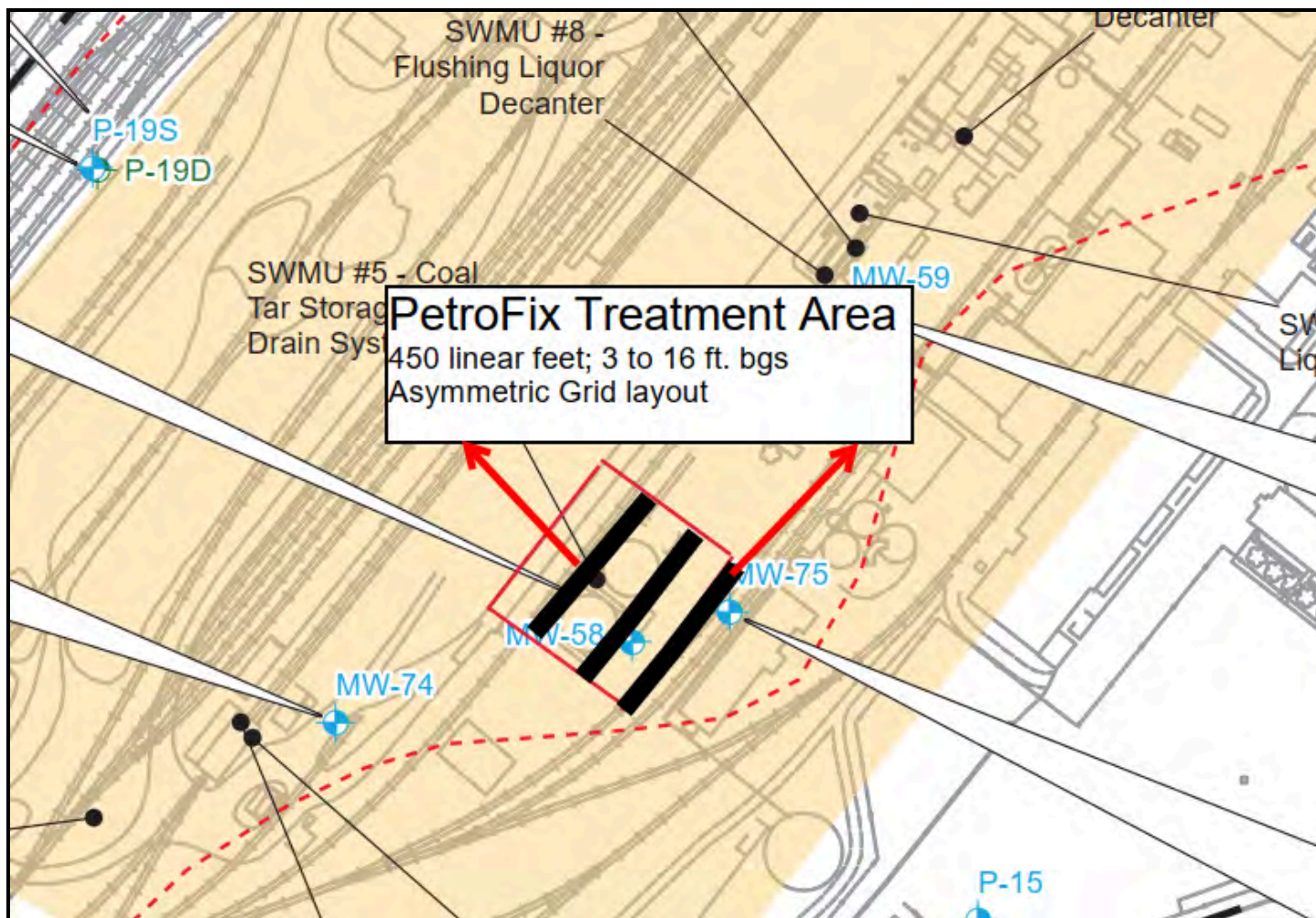
Click above to access product specification sheets

Design Summary

Design Parameters	Unit	Value
Barrier Length	ft	450
Top Treat Depth	ft	3
Bot Treat Depth	ft	16
Vertical Treatment Interval	ft	13
Soil Type		Fine >75% Silt/Clay
GW Velocity	ft/yr	<150
Application Summary		
Number of Rows		1
Spacing Between Rows	ft	NA
Spacing Between Points	ft	5.0
Injection Points		90
Eff. Pore Volume Occupancy		59%
RRS Application Days onsite		14
Product Dosage		
PetroFix Remedial Fluid	lb	12,400
Electron Acceptor Blend	lb	620
Water Required	gallons	37,363

Representative Case Studies

- [PetroFix Case Study - Former Gas Station Closure and +99% Reductions - CO](#)
- [PetroFix Case Study - Engineering Rapid Closures Multi-Site](#)
- [PetroFix Case Study - All](#)



Technical Approach

PetroFix is a unique activated carbon remedial fluid (carbon milled to a diameter of 1 to 2 micrometers) paired with soluble, anaerobic electron acceptors designed to remediate dissolved hydrocarbons. This allows the product to be injected as a fluid using low pressure. PetroFix is commonly used for source and plume treatment, excavation polishing, and barrier applications. PetroFix features:

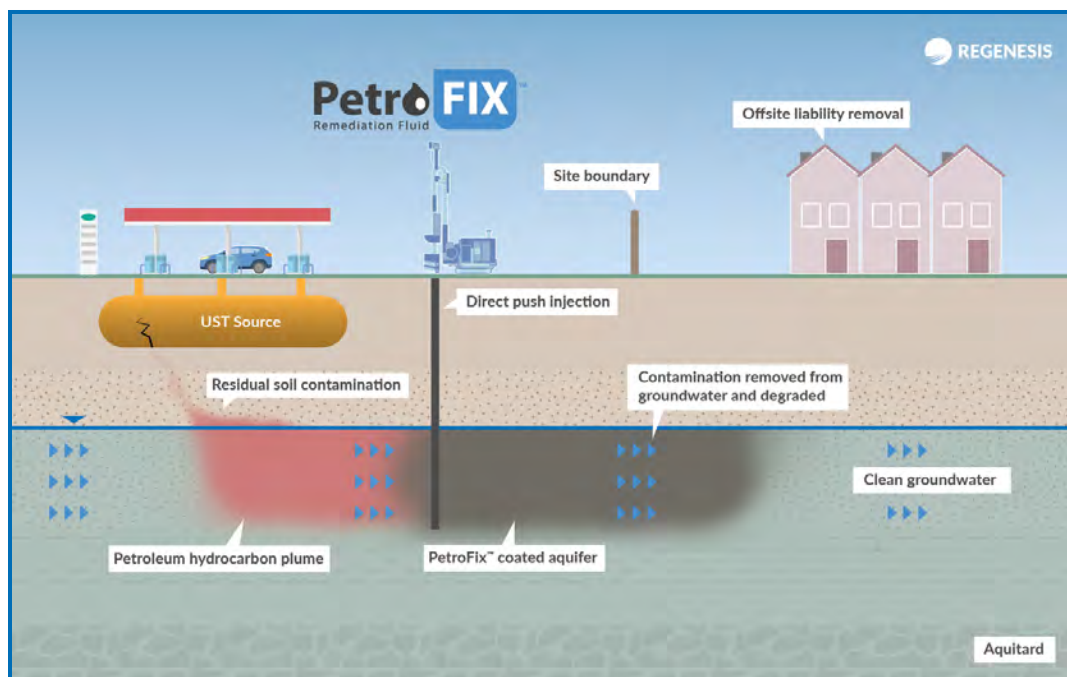
- Provides rapid and sustained results allowing for faster and more certain site closure
- Dual-technology approach relies on both carbon sorption and anaerobic biodegradation
- Low-pressure "flooding" vs high pressure "fracturing" improves distribution and reduces surfacing
- Safe to handle because is non-hazardous and shipped as a liquid (no fugitive carbon dust)
- Mitigates hydrocarbon back diffusion which is a cause of concentration rebound

PetroFix is typically self-applied and is supported by a large library of application instruction, technical bulletin, and videos (www.petrofix.com/resources). Based on our experience at hundreds of sites we have developed recommendations listed in a hyperlinked planning document included in the following sections. Below are links for additional technologies information:

[PetroFix® - An Animated Overview](#)

[PetroFix® - All Webinars](#)

[PetroFix Monitoring Parameters](#)



Statement of Qualifications

REGENESIS Remediation Services (RRS) provides turn-key remediation planning, design, and application services. RRS field scientists are college degreed professionals that understand the details of each remediation design, the site conceptual site model, the remediation chemistry being applied, the significance of the designed reagent dosing and achieving subsurface distribution, and how a breakdown of any one of these and other factors can result in poor remediation performance. They have the unique background and experience to understand the significance of modifications made in the field.

RRS' direct management of the injection program optimizes the design and ultimately, the overall remedy performance. No one has more professional experience handling and applying in situ remediation products than RRS personnel.

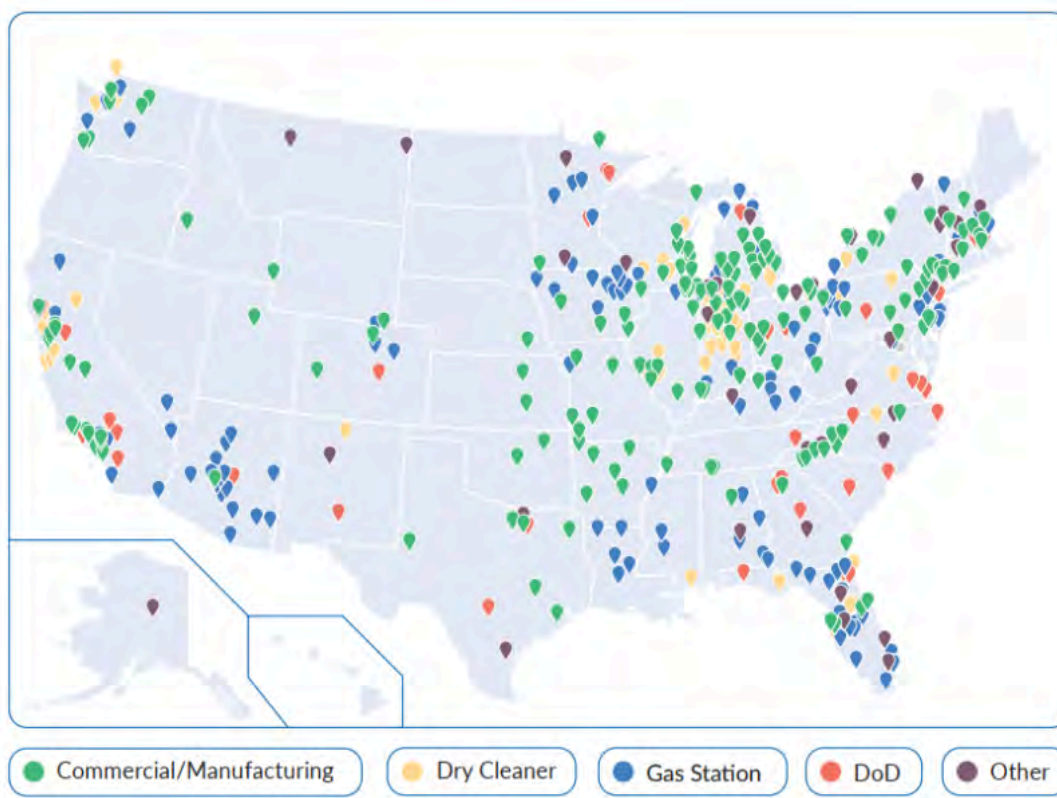
RRS has been offering industry-leading application services combined with excellence in field activity management for over a decade. We achieve success by meeting the cleanup objectives established by the environmental engineering firms who contract our services. To produce this outcome, we field experienced, disciplined, and dedicated project teams who work with our clients to address the unique requirements of each project site. Astute technical insight and timely, direct, and honest communication are hallmarks of RRS. Our reputation for meeting or exceeding clients' objectives has been proven in project successes throughout North America.

Further information on what sets RRS apart is provided in the following technical resources:

- [RRS: Performance Driven, Results Based](#)
- [The RRS Difference](#)

With decades of application experience, RRS is strategically located across the country to mobilize and assist on a wide range of sites throughout the US.

Over 100 Projects Completed Annually Across the US



RRS Scope of Services

RRS will work under the direction of to implement the remedy in the field, applying the selected remediation technologies. RRS and will share the responsibilities for implementing this scope of work. The delegation of responsibilities is outlined in this section and under the Assumptions/Qualification section. At the beginning of each day, RRS will conduct a safety tailgate meeting and review the day's goals, procedures, and responsibilities.

RRS will be equipped with multiple injection tool options to use with 1.5-inch diameter DPT rods. The injection tool string will be advanced to the top or bottom of the target treatment zone and injections will be performed in a bottom-up or top-down method depending on the site lithology.

The remediation technologies will be mixed in an injection trailer (Figure 2) with water in batches at the designated solution percentage and kept in constant suspension throughout the injection application. Pressures, flow rates, and total volume will be monitored and digitally documented for each injection interval. Simultaneous injection at multiple locations may be conducted to increase efficiencies on-site. RRS will monitor the injection points and surrounding areas for any signs of surfacing, and a spill response kit will be on standby.

During the application, real-time information will be collected and analyzed to help verify design assumptions and subsurface reagent distribution. Depending on the primary product applied, data collected and analyzed may consist of groundwater quality parameters (i.e., pH, conductivity, DO, ORP, etc.), depth-to-water measurements, visual indicators through groundwater or soil samples, and in-field injection concentration test kits. This information is typically collected during the application when operating within 10 feet of an appropriately screened monitoring well. Based on the information collected, the project team may modify the remediation design to optimize the injection application further. Typical modifications may include injection concentrations, volume per vertical foot, injection intervals, and point spacing.

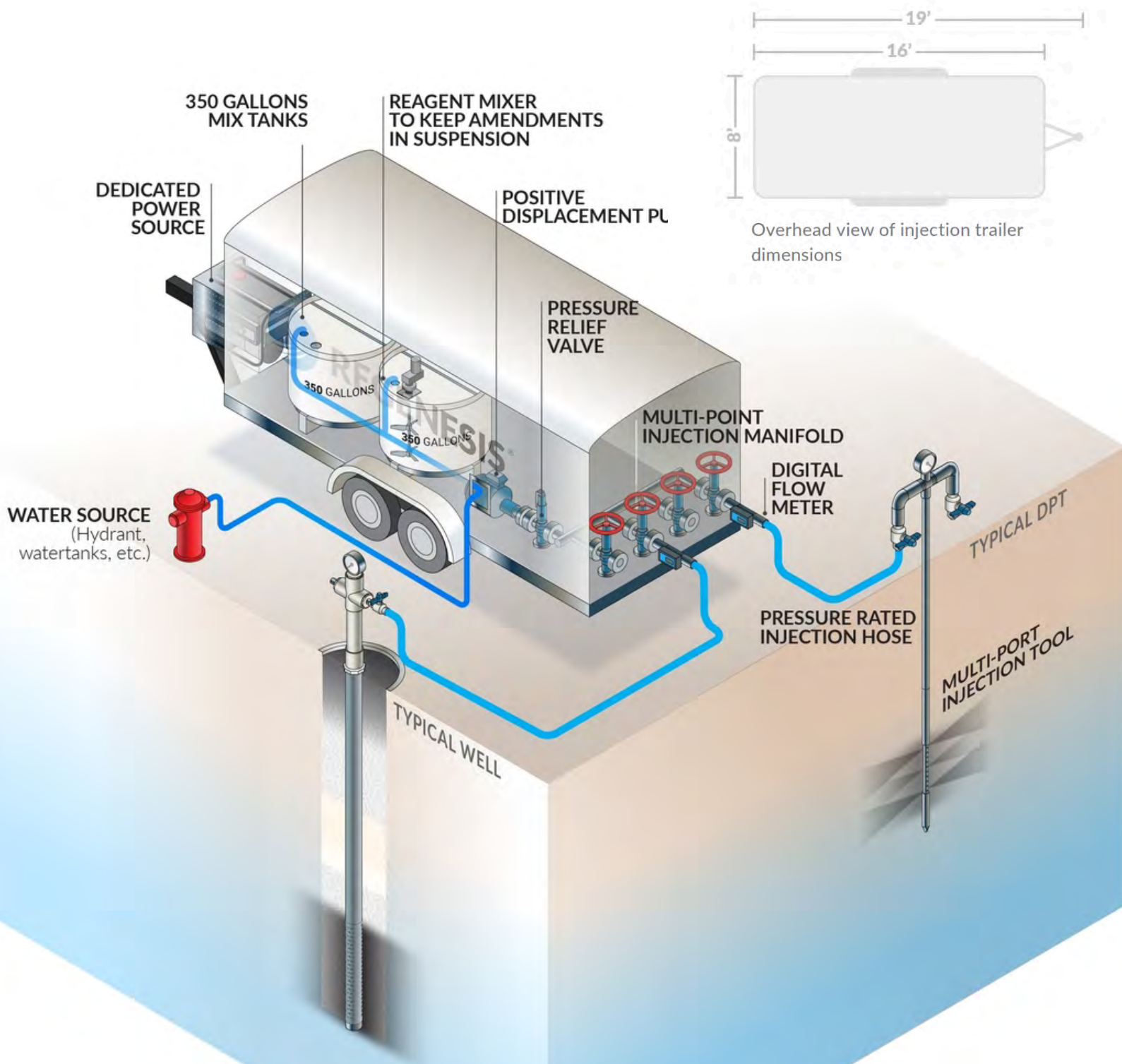
Once the injection event is completed, RRS will demobilize all equipment and personnel off-site. A detailed injection summary report which includes injection point data (interval depths, injection pressure/flow rates, reagent volume, time elapsed and if surfacing occurred), field observations and any other noteworthy information, will be prepared and submitted to

Custom-Built Application Equipment

RRS maintains a dedicated fleet of ready-to-deploy application systems strategically located throughout the US that provide comprehensive injection services, reliability, and accountability.

RRS has numerous purpose-built reagent application systems and can modify systems and appurtenances to accommodate any scenario.

Figure 2: RRS Application Trailer



Project Responsibilities

RRS will:

- Provide and ship the specified quantities of the remediation reagents to the site address provided by . RRS shipping estimates assume all products will be shipped to the site simultaneously.
- Coordinate with prior to any shipment of product. Alternative shipping locations or phases could lead to an increase in freight costs.
- Mobilize a 40-hour HAZWOPER certified crew experienced in correctly applying REGENESIS remediation technologies.
- Provide a forklift for the project's duration to maneuver the product containers.
- Contract a qualified, licensed DPT drilling operator equipped with the necessary tooling and materials to safely complete the application scope of work outlined within this proposal. Equipment to be mobilized includes:
 - Track-mounted DPT rig capable of reaching the target depth
 - Two-person crew
 - Enough rods to drill up to 5 locations simultaneously
 - Teflon tape for all rod joints
 - Granular bentonite, and bentonite chips.

will:

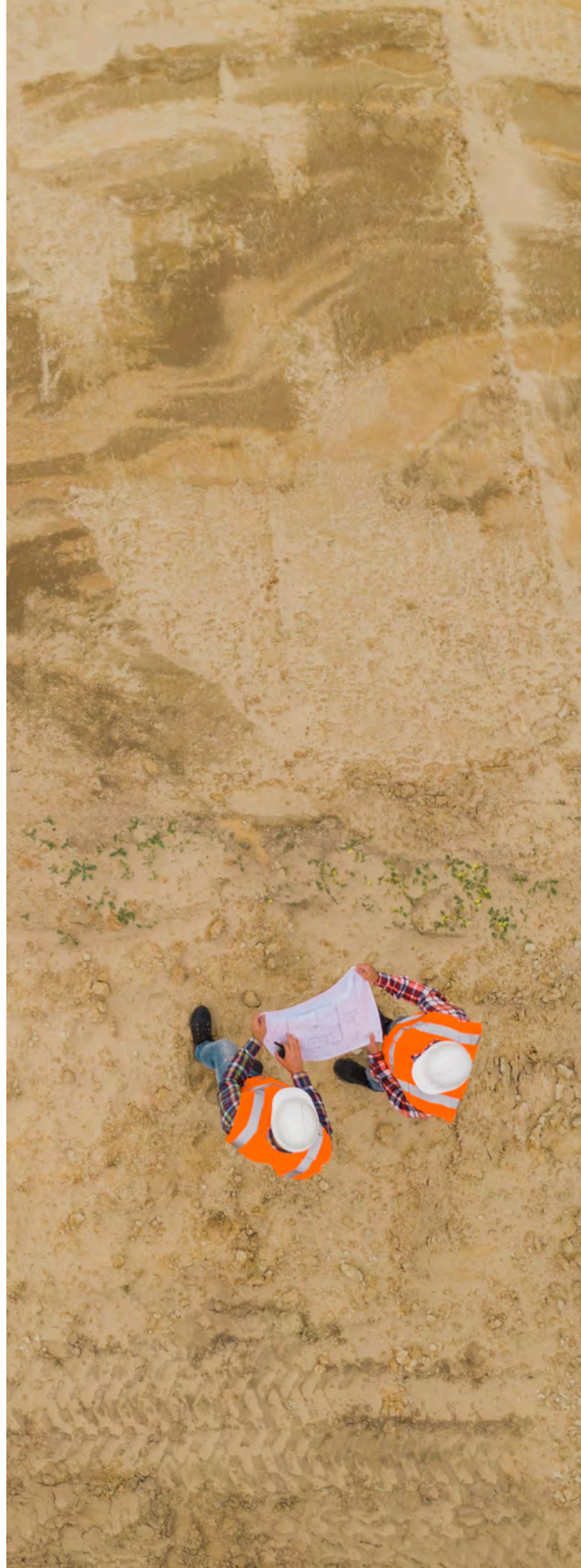
- Coordinate project schedule and reagent order with RRS to ensure adequate shipping and mobilization time.
- Coordinate site access with the property owner to coincide with the project schedule and identify a secure product staging area.
- Take delivery of the remediation chemistry prior to RRS mobilization and stage inside a secure storage location where the material will not be affected by inclement weather. During injection activities, will ensure the product is stored in a location accessible by the RRS-rented forklift.
- Should private underground utilities be within the treatment area, will contract with a private utility locating service to mark utilities prior to RRS mobilization.
- Provide a water source (e.g. hydrant) capable of producing at least 30 GPM for the project duration within 300 ft. of the project staging area, at no cost to RRS.
- Be responsible for disposal or recycling of totes, drums, pails and pallets. All nonhazardous refuse will be collected and placed in a -provided on-site refuse container for disposal. RRS will collect project related refuse and empty treatment chemistry containers daily to keep the site clean.
- Be responsible for transportation and disposal of any contaminated waste generated on-site during injection activities, though we do not anticipate generating any such waste.
- will provide field water quality meter similar to a YSI 556 with a down-hole sensor, a water level meter, bailers and a technician while on-site for injection activities to assist RRS in assessing groundwater from monitoring wells.

Services Assumptions and Qualifications

In generating this proposal, RRS relied upon professional judgment and site-specific information provided by others. Using this information as input, we performed calculations based upon known chemical and geologic relationships to estimate product quantities and subsurface placement required to achieve the remedial goals. The attached design summary tables specify the assumptions used to complete the remedial design. We request that these modeling input assumptions be verified by your firm before injection. Other assumptions and qualifications related to this proposal are as follows:

- The product and services cost outlined will be valid for 60 days the proposal date. If beyond 60 days, RRS reserves the right to update the cost.
- The freight charges included for product delivery above are estimated at the time of proposal generation. Actual freight charges are neither set nor guaranteed by RRS and are calculated when the product order is placed. This price may vary from what is estimated above. Actual freight charges for product delivery will be invoiced.
- Freight delivery time frames cannot be guaranteed and RRS will not be responsible for any delays or increased costs associated with those delays.
- If applicable, sales tax charges for product, freight, and services are considered estimated at the time of proposal submittal. The appropriate sales tax category (i.e., product, freight, and services) and actual sales tax rate are finalized at the time of invoice and may change from date of proposal submittal.
- RRS will have access to the site for equipment operation and secure storage of materials and equipment throughout the project duration. Access to each work area location will be clear and free of obstructions. RRS also assumes the injection trailer can be staged within 80 feet of the furthest injection point location.
- is responsible for securing any permits prior to mobilizing to the site.
- is responsible for all soil, air, and groundwater sampling and analysis.
- For safety reasons, access to the treatment area will be limited to RRS and personnel.
- The remediation design and injection procedures contain the necessary precautions to minimize the likelihood of surfacing of the treatment chemistry. RRS will monitor the injection flow rates and pressures and observe for signs of reagent surfacing around active injection areas. If surfacing is detected, RRS will stop or slow down injection activities at that location to stop additional surfacing and remove/vacuum up recoverable surfaced fluid. RRS is not responsible for treatment chemistry infiltration into undesired locations beyond our visible control.
- RRS personnel will have access to the site for work up to 12 hours per day Monday through Friday (daylight hours). However, the standard workday does not exceed 10 hours with travel time Monday through Friday. A 10-hour workday does not mean 10 hours on-site and/or injection pumping. Additional charges may apply for work completed on Saturday and Sunday.
- RRS is not responsible for damage to unmarked utilities and subsurface structures. will review as-built drawings with RRS to confirm clearance prior to advancing DPT injection tooling and marking injection point locations.
- Pricing and work schedule assume union labor and prevailing wages (Davis-Bacon) are not required.

- This proposal assumes probing and drilling will begin at the ground surface. If hand auger, concrete/asphalt coring, or air knife services are required, additional charges, including for surface restoration could apply.
- RRS assumes that direct-push style drill rig can access all injection point locations and drive 1.5" diameter injection tooling to the required depth. If site conditions limit the use of the provided direct-push rig or tooling for any injection point and other drilling methods are required to complete the task, additional charges will apply.
- All traffic control requirements, if necessary, will be provided by .
- RRS will close/backfill all injection points to ground surface with bentonite. Ground surface restoration costs have not been included. Additional charges will apply if surface restoration is needed.
- Site conditions can change over time and should be monitored post injection. RRS is not responsible for changing site conditions after completing the scope of work and demobilizing. Such changes include but are not limited to changes related to borehole abandonment (i.e., swelling of backfill material), surface restoration, well conditions, and on-site utilities.



Health and Safety Plan

RRS is committed to providing a safe and healthy working environment for all on-site employees, including contractors on-site. Before mobilization, RRS will develop a site-specific Health and Safety Plan (HASP) and designate an on-site safety officer. All personnel on-site are required to participate in daily safety tailgate meetings to proactively identify potential hazards and mitigate risks to the full extent possible.

In addition to the hours of rigorous safety training courses all personnel are required to complete, RRS also incorporates a behavior-based safety program by utilizing our DoneSafe mobile application (app) interface on every site. This app encourages our personnel to actively search for potential on-site risks and document mitigation actions. The effectiveness of our safety program can be seen in our industry leading Experience Modification Rating (EMR) listed in Table 3.

Year	Total Hours	EMR
2021	125,592	0.71
2020	162,037	0.64
2019	169,964	0.66
2018	144,600	0.70
2017	140,706	0.70

RRS safety tailgate meetings and HASP will include the following:

- Site map with entrance and exit points and best possible muster points depending on conditions.
- List of personnel and contact information for employees on-site and supporting the project.
- Route to the nearest occupational treatment facility and hospital along with contact information.
- Job Hazard Analysis (JHA) detailing each job task on-site with its potential hazards and best practices to avoid those hazards.
- Description and hazards of the contaminants of concern (COC) with appropriate Personal Protection Equipment (PPE) requirements.
- COVID-19 precautions will be discussed, and personnel will be equipped with face coverings.
- List and description of REGENESIS chemicals on-site including a Safety Data Sheet (SDS) for each chemical.
- Checklist of site safety equipment including fire extinguishers, eyewash station, first aid kit, spill prevention kit and any site-specific equipment needed.
- Daily tailgate safety meeting sheet with identified hazards and risks associated with the site and job tasks for that day, along with shared learning observations from the previous day.



Detailed Design Tables



PetroFix™ Application Summary
Barrier Estimate
Bluestone Coke
Barrier 1



PetroFix Amount	12,400 lb
Electron Acceptor Amount	620 lb
Barrier Length	450 ft
Delivery Points	90
Point Spacing Within Rows	5.0 ft
Point Spacing Between Rows	N/A ft
Number Of Barrier Rows	1
Top of Treatment Interval	3.0 ft bgs
Bottom of Treatment Interval	16.0 ft bgs
Treatment Area	4,500 ft ²
PetroFix Dose Within Barrier	5.7 lb/yd ³

Mix Tank Volume*	275 gal
Dilution Factor	26.0 x
PetroFix per Mix Tank	9.0 gal
Water per Mix Tank	266.0 gal
Electron Acceptor per Mix Tank	4.4 lb
Number of Batches Required	140.5

*Adjust tank volume to that used in field.

Reported Groundwater Concentrations (mg/L)	
Benzene	1.000
Toluene	0.000
Ethylbenzene	0.000
Xylenes	0.000
Trimethylbenzenes	0.000
Butylbenzene	0.000

Application Resources (www.petrofix.com/resources):
[Summary of PetroFix Direct Push Application Instructions](#)
[PetroFix Pre-Application Presentation \(Includes Field Verification Testing\)](#)
[Storage requirements for freezing or hot weather](#)
[Safety Data Sheets \(SDS\)](#)

Total Volume	38,633 gal
Product Volume	1,269 gal
Water Volume	37,363 gal
Injection Volume Per Point	429 gal
Injection Volume Per Vertical Foot	33 gal
Product/Point	14.1 gal
Water/Point	415.1 gal
Soil Type	Fine >75% Silt/Clay
Effective Pore Volume Fill %	59%

AREA NOTES

Distribute 450 linear feet through three (3) barriers.

Isopropylbenzene	0.000
Naphthalenes	17.000
MTBE	0.000
TPH-GRO	3.000
TPH-DRO	0.000
TPH-ORO	0.000

Please call the number below or 949-366-8000 if you have any questions.

Site Address:
3500 35th Avenue, Birmingham, AL

PetroFix[™] Specification Sheet

PetroFix Technical Description

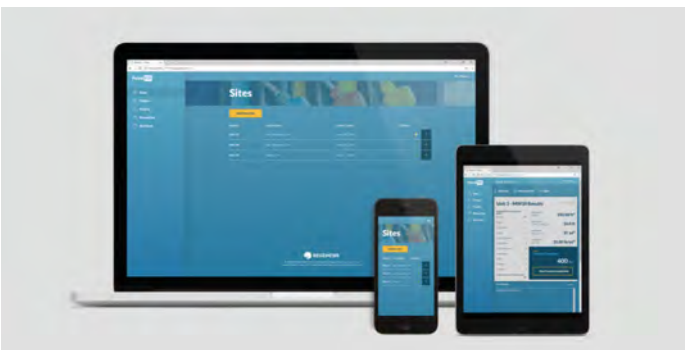
PetroFix is a new remedial technology designed to treat petroleum fuel spills in soil and groundwater. A simple-to-use fluid that can be applied under low pressure into the subsurface or simply poured into open excavations, PetroFix offers a cost-effective solution for environmental practitioners and responsible parties to address petroleum hydrocarbon contaminants quickly and effectively.

PetroFix has a dual function; quickly removing hydrocarbons from the dissolved phase, by absorbing them onto the activated carbon particles, while added electron acceptors stimulate hydrocarbon biodegradation in-place. PetroFix does not require high pressure “fracking” for application and can be applied with ease using readily available equipment associated with direct push technology.



The remedial fluid is a highly concentrated water-based suspension consisting of micron-scale activated carbon and biostimulating electron acceptors. PetroFix has a viscosity higher than water and is black in appearance. Its environmentally-compatible formulation of micron-scale activated carbon (1-2 microns) is combined with both slow and quick-release inorganic electron acceptors. A blend of additional electron acceptors is included along with the PetroFix fluid. Practitioners can select between a sulfate and nitrate combination blend (recommended), or sulfate only for the additional electron acceptors required.

PetroFix Design Assistant



REGENESIS has developed a proprietary web-based design assistant called PetroFix Design Assistant[™] that provides environmental professionals the ability to input their site parameters, determine the required product amount, and order the product through REGENESIS' customer service. The PetroFix Design Assistant includes defaults and warnings throughout the process to guide users toward effective designs that will offer best results.

To access the PetroFix Design Assistant, create an account and login at www.PetroFix.com

Chemical Composition

Activated Carbon - CAS 7440-44-0 > 30%
Calcium Sulfate Dihydrate - CAS 10101-41-4 < 10%

Properties

Appearance: Black Fluid
Viscosity: 1500-3500 cP (corn syrup-like)
pH: 8-10

Storage and Handling Guidelines

Storage:

- Store away from incompatible materials
- Store in original closed container
- Store at temperatures between 40°F and 95°F
- Do not allow material to freeze
- Dispose of waste and residues in accordance with local authority requirements

Handling:

- Never add additives to solution prior to mixing with water
- Wear appropriate personal protective equipment
- Do not taste or ingest
- Observe good industrial hygiene practices
- Wash hands after handling

Applications

PetroFix is mixed with water on-site and easily applied onto the sub-surface using low pressure injections, or mixed in excavations. PetroFix is compatible with and can be used with ORC Advanced® to expedite rates of biodegradation. For more information about co-application with ORC Advanced, contact REGENESIS.

SAFETY DATA SHEET

1. Identification

Product identifier PetroFix
Other means of identification None.
Recommended use Remediation of contaminants in soil and groundwater.
Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Company Name REGENESIS
Address 1011 Calle Sombra
 San Clemente, CA 92673 USA
General information 949-366-8000
E-mail CustomerService@regenesisis.com

Emergency phone number For Hazardous Materials Incidents ONLY (spill, leak, fire, exposure or accident), call CHEMTREC 24/7 at:
USA, Canada 1-800-424-9300
International 1-703-527-3887

2. Hazard(s) identification

Physical hazards Not classified.
Health hazards Not classified.
OSHA defined hazards Not classified.

Label elements

Hazard symbol None.
Signal word None.
Hazard statement The mixture does not meet the criteria for classification.
Precautionary statement
Prevention Observe good industrial hygiene practices.
Response Wash hands after handling.
Storage Store away from incompatible materials.
Disposal Dispose of waste and residues in accordance with local authority requirements.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information None.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Activated carbon <10 µm	7440-44-0	>25
Calcium sulfate dihydrate	10101-41-4	<10
Additive	-	<2

Composition comments All concentrations are in percent by weight unless otherwise indicated. Components not listed are either non-hazardous or are below reportable limits. Chemical ingredient identity and/or concentration information withheld for some or all components present is confidential business information (trade secret), and is being withheld as permitted by 29 CFR 1910.1200(i).

4. First-aid measures

Inhalation Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
5. Fire-fighting measures	
Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	None known.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed. Combustion products may include: carbon oxides, nitrogen oxides, sulfur oxides, calcium oxide.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	This material will not burn until the water has evaporated. Residue can burn. When dry may form combustible dust concentrations in air.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water.
	Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.
	Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store in tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
Activated carbon <10 µm (CAS 7440-44-0)	TWA	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Activated carbon <10 µm (CAS 7440-44-0)	TWA	2 mg/m3	Respirable fraction.
Calcium sulfate dihydrate (CAS 10101-41-4)	TWA	10 mg/m3	Inhalable fraction.

Biological limit values	No biological exposure limits noted for the ingredient(s).
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Appropriate engineering controls	Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Individual protection measures, such as personal protective equipment	
Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.
Skin protection	
Other	Wear suitable protective clothing.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state	Liquid.
Form	Aqueous suspension.
Color	Black.
Odor	Odorless.
Odor threshold	Not available.
pH	8 - 10
Melting point/freezing point	32 °F (0 °C).
Initial boiling point and boiling range	212 °F (100 °C)
Flash point	Not applicable.
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.
Vapor pressure	Property has not been measured.
Vapor density	Property has not been measured.
Relative density	Property has not been measured.
Solubility(ies)	
Solubility (water)	Not determined.
Partition coefficient (n-octanol/water)	Not applicable, product is a mixture. Not applicable, product is a mixture.
Auto-ignition temperature	Property has not been measured.
Decomposition temperature	Property has not been measured.
Viscosity	Not available.
Other information	
Density	Property has not been measured.
Explosive properties	Not explosive.
Flammability	This material will not burn until the water has evaporated.
Kinematic viscosity	Property has not been measured.
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.

Conditions to avoid	May generate combustible dust if material dries. Contact with incompatible materials. Avoid drying out product.
Incompatible materials	Acids. Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Spray mist may irritate the respiratory system. For dry material: Dust may irritate respiratory system.
Skin contact	Prolonged or repeated exposure may cause minor irritation.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	May cause discomfort if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity Not expected to be acutely toxic.

Components	Species	Test Results
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Activated carbon <10 µm (CAS 7440-44-0)

Acute

Oral

LD50 Rat > 10000 mg/kg

Skin corrosion/irritation Prolonged skin contact may cause temporary irritation. Based on available data, the classification criteria are not met.

Serious eye damage/eye irritation Direct contact with eyes may cause temporary irritation. Based on available data, the classification criteria are not met.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer. Based on available data, the classification criteria are not met.

Skin sensitization This product is not expected to cause skin sensitization. Based on available data, the classification criteria are not met.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic. Based on available data, the classification criteria are not met.

Carcinogenicity Not classifiable as to carcinogenicity to humans. Based on available data, the classification criteria are not met.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

NTP Report on Carcinogens

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects. Based on available data, the classification criteria are not met.

Specific target organ toxicity - single exposure Not classified. Based on available data, the classification criteria are not met.

Specific target organ toxicity - repeated exposure Not classified. Based on available data, the classification criteria are not met.

Aspiration hazard Not an aspiration hazard. Based on available data, the classification criteria are not met.

Chronic effects Prolonged inhalation may be harmful.

Further information No other specific acute or chronic health impact noted.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential	No data available.
Mobility in soil	No data available.
Other adverse effects	None known.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not established.

15. Regulatory information

US federal regulations This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

Toxic Substances Control Act (TSCA) All components of the mixture on the TSCA 8(b) inventory are designated "active".

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations

US. Massachusetts RTK - Substance List

Calcium sulfate dihydrate (CAS 10101-41-4)

US. New Jersey Worker and Community Right-to-Know Act

Not listed.

US. Pennsylvania Worker and Community Right-to-Know Law

Not listed.

US. Rhode Island RTK

Activated carbon <10 µm (CAS 7440-44-0)

Calcium sulfate dihydrate (CAS 10101-41-4)

California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins. For more information go to www.P65Warnings.ca.gov.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Industrial Chemicals (AICIS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	15-February-2018
Revision date	02-December-2021
Version #	02
HMIS® ratings	Health: 1 Flammability: 1 Physical hazard: 0 Personal protection: B

NFPA ratings**Disclaimer**

Regenesis cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

NFA STATUS ACHIEVED AT VIRGINIA GAS STATION SITE

CASE STUDY:
PetroFix Application Reduces
BTEX, Naphthalene, and
TPH-GRO Concentrations



REGENESIS®



Site Details

Contaminants of Concern	Benzene Toluene Ethylbenzene Xylenes TPH-GRO Naphthalene
Treatment Interval	13-20 ft. bgs
Geology	Silty Sand
Total Direct Push Points	153
Total Amount of PetroFix Applied	15,200 lbs.



Uni-Tech Drilling injects PetroFix Remediation Fluid into the soil using a GeoProbe

Overview

Groundwater Remediation Plan to Eliminate Contaminants from Underground Storage Tank

As a result of a reported release during routine maintenance at a retail fueling center (gas station), the Virginia Department of Environmental Quality (VADEQ) required the owner of the fueling center to conduct a Site Characterization Assessment. Sovereign Consulting Inc. (Sovereign) was retained to conduct the assessment which necessitated installing a total of seven (7) 2-inch diameter groundwater monitoring wells around and down-gradient of the underground storage tank (UST) location as part of a state-mandated Site Characterization Assessment.

During the initial monitoring well gauging, approximately two feet of light non-aqueous phase liquid (LNAPL) was identified in the monitoring well down-gradient to the UST and two inches of LNAPL identified in the side-gradient monitoring well. Sovereign conducted monthly LNAPL (gasoline) recovery until the monitoring wells were free of LNAPL for three consecutive gauging cycles.

Sovereign was then retained to demolish the fueling center and remove the 25,000-gallon gasoline UST and the associated fueling system which represented the source of the contamination. Due to the predominantly sandy site soils and depth to groundwater, no contamination, odors or elevated PID levels were noted during the UST removal. Therefore, no soil excavation was conducted during the UST removal.

Once the source of contamination (UST) and the free-product was addressed, Sovereign worked with REGENESIS to formulate and execute a groundwater remediation plan.

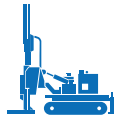
Timeline

Remediation Efforts Using PetroFix Result in Case Closure by VADEQ



February 2018

Installation of initial groundwater monitoring wells



March 2018

Remedial Investigation of groundwater to delineate dissolved-phase VOCs



April-October 2018

LNAPL Recovery Program



May 2018

Installation of additional monitoring wells to further delineate plume



June 2018

Submission of the Site Characterization Report Addendum to VADEQ



August 2018

UST and fueling system removal and fuel center demolition by Sovereign



May-June 2019

Injection of PetroFix using GeoProbe



June-December 2019

Post-treatment groundwater sampling and quarterly reporting to VADEQ



December 2019

Pollution Complaint Case closure by DEQ

Treatment

PetroFix Groundwater Treatment Led to Rapid Decrease in Contamination

Site Goal:

The treatment goal was not to remove the entire extent of dissolved VOCs in site groundwater. The treatment approach was designed to achieve a significant reduction in the VOC contamination in the groundwater, to prevent the further down-gradient migration of the plume and to enhance natural biodegradation of any remaining dissolved phase hydrocarbons.

Application Strategy:

Step 1: Single application of PetroFix downgradient of the plume to create a 100-foot subsurface treatment barrier to prevent the further migration of the dissolved phase plume. The barrier consisted of 40 injection points placed in two (2) staggered rows of 20 injection points with five (5) foot horizontal spacing.

Step 2: Single application of PetroFix into the source area using an injection grid of 33 points with a six (6) foot horizontal spacing centered around MW-06.

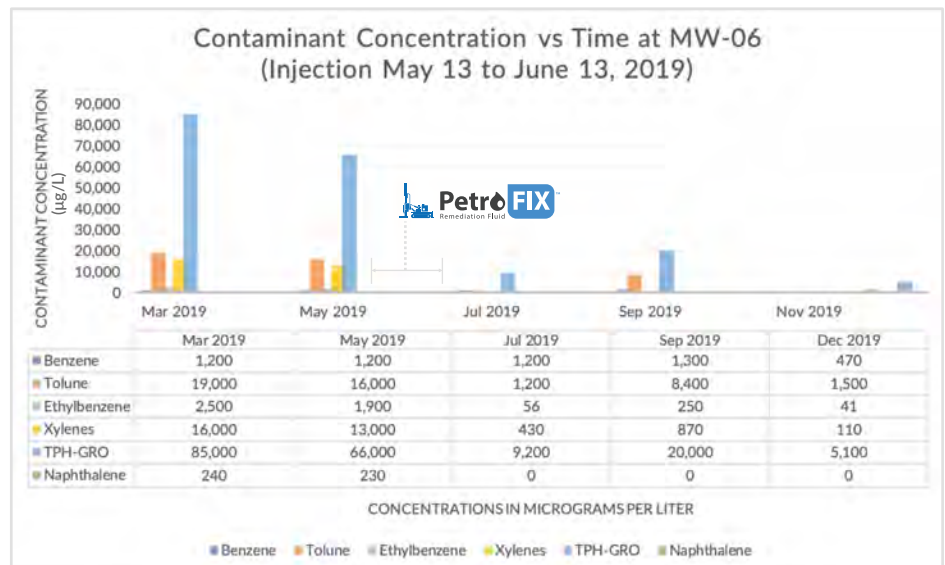
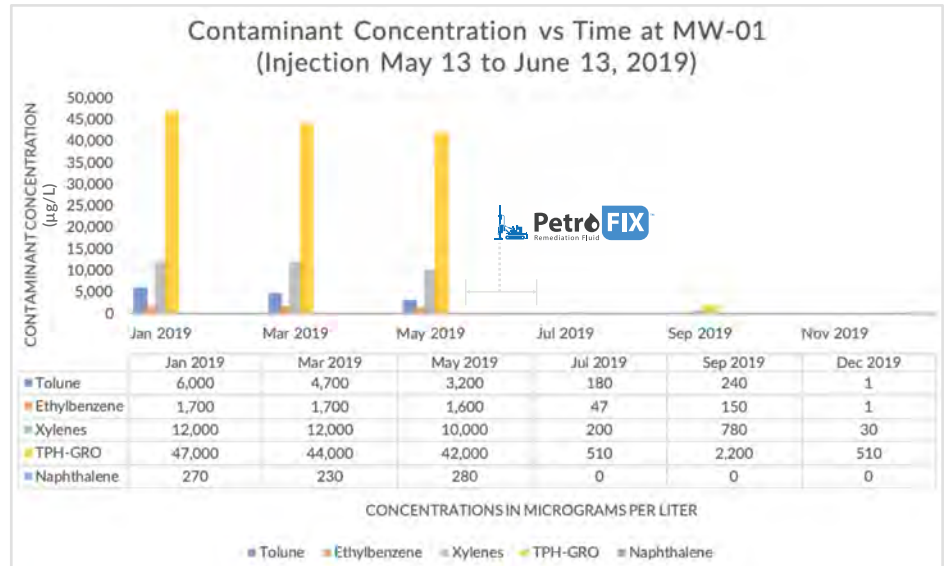
Step 3: Single application of PetroFix to the migrating plume area using 80 injection points with six (6) foot horizontal spacing.

Sovereign worked with REGENESIS to develop a treatment plan. Using the estimated release volume, chemical constituents, geologic information from the drilling logs, the estimated mass of the dissolved contamination was calculated. Each groundwater gauging and sampling event was used to develop site plume models and to generate a basic site conceptual model. This model resulted in identifying three project goals. First, treat the source area where the former UST was located. Second, treat the plume that was migrating downgradient from the source area. And third, create a sub-surface barrier or treatment curtain to prevent migration of the plume to the down-gradient horizontal control (i.e., clean) monitoring well.

Due to the high levels of dissolved hydrocarbons in the groundwater, an application of PetroFix with an electron acceptor additive was recommended to reduce the dissolved phase mass in the source and treatment areas. Next, the treatment area, number of delivery points, horizontal point spacing, vertical treatment interval and PetroFix dose was formulated. This resulted in the application of 15,200 pounds of PetroFix in the three project areas. PetroFix and the additive were mixed with a large volume of water and injected with a GeoProbe to treat a thirteen (13) foot vertical interval at 153 delivery points over a three to four week period. Following the injections, PetroFix was observed in the monitoring wells in the treated areas which confirmed its distribution throughout the subsurface soils.

Unlike other groundwater treatment materials, PetroFix was utilized due to its dual function – it quickly removes hydrocarbons from the dissolved phase by absorbing them onto the activated micro-carbon particles and the electron acceptors promote hydrocarbon biodegradation *in situ* to encourage continued remediation. This combination resulted in a rapid decreases in contamination in weeks as opposed to months as determined through monitoring well groundwater sampling and the corresponding concentration curves for each chemical of concern.

Results



Site Closure Achieved After Successful PetroFix Application

The remediation approach using PetroFix successfully reduced the BTEX, naphthalene and TPH-GRO concentrations sufficiently for the VADEQ to close the case. The duration of the PetroFix treatment and the corresponding groundwater sampling program was less than a year to closure.



Technology

PetroFix Remediation Fluid



PetroFix has a dual function: it removes hydrocarbons from the dissolved phase by adsorbing them on to activated carbon particles and then stimulates hydrocarbon biodegradation by adding electron acceptors. PetroFix is a highly concentrated water-based suspension consisting of micron-scale activated carbon and biostimulating electron acceptors. The environmentally-compatible formulation of micron-scale activated carbon (1-2 microns) is combined with both slow and quick-release inorganic electron acceptors. Practitioners can select between a sulfate and nitrate combination blend (recommended) or sulfate only for the additional electron acceptors required.



The Consultant

Sovereign Consulting Inc.

Sovereign Consulting Inc. (Sovereign) is a full-service environmental consulting firm working with commercial, industrial and municipal clients to solve their most challenging environmental challenges to help them reduce their long-term environmental liabilities and the associated financial risk. Sovereign provides Licensed Site Remediation Professional (LSRP) support, site assessment and characterization, and soil/groundwater remediation design, construction and O&M services to a wide-range of clients including the retail petroleum industry, legacy chemical facilities and transportation terminal clients.

Visit www.sovcon.com to learn more.



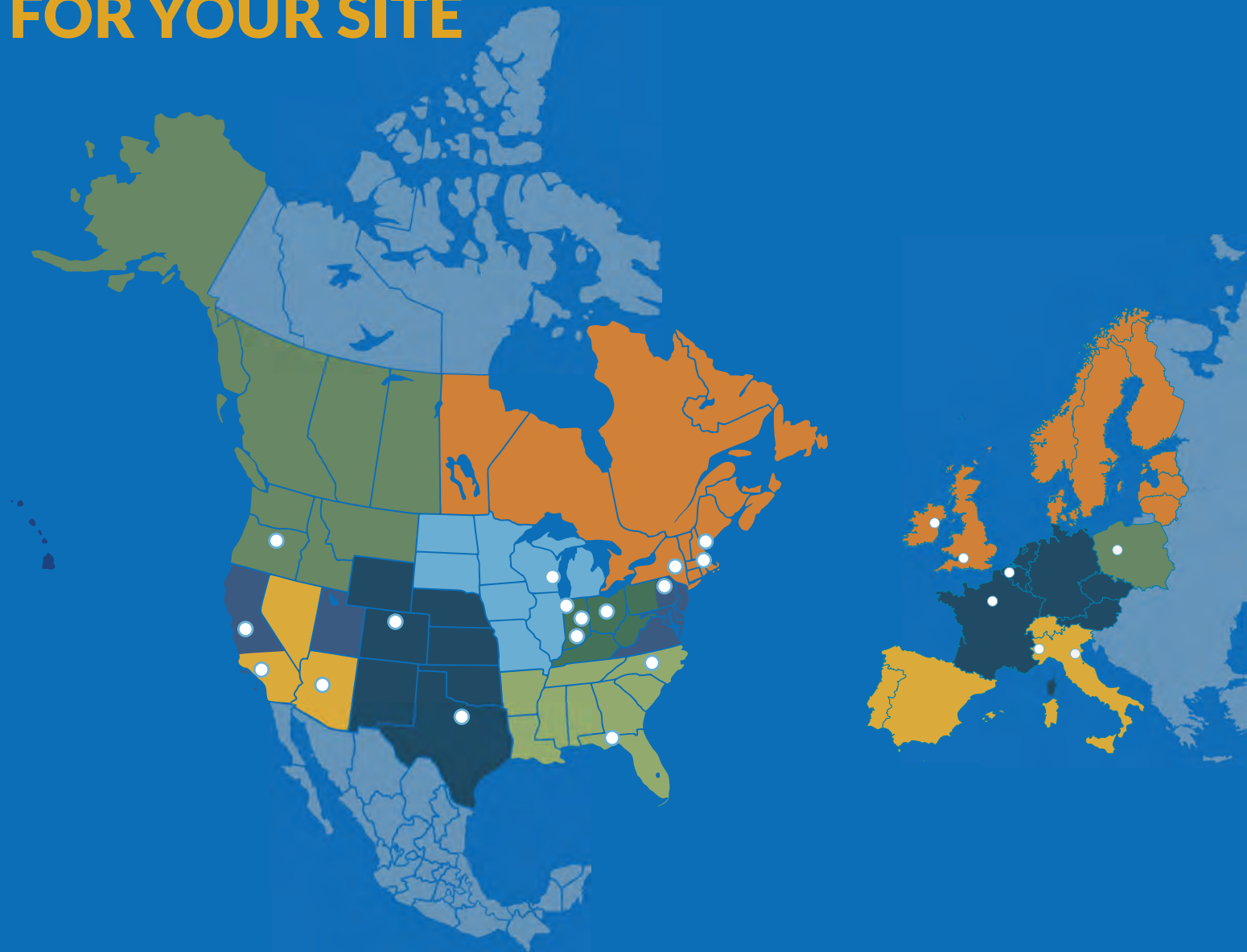
About the Project Manager

Greg Janiec

Mr. Janiec is a Senior Project Manager at Sovereign and has over thirty years of environmental experience managing disaster response, site assessment and characterization and site remediation projects across the country. Currently, he is focused on assisting commercial clients with Phase II Environmental Site Assessments, fueling center demolition and UST removal and soil/groundwater remediation supporting property divestment and acquisition; and supporting redevelopment clients with environmental issues associated with EPA grant-funded Brownfields projects.

Contact Greg Janiec at gjaniec@sovcon.com

WE'RE READY TO HELP YOU FIND THE RIGHT SOLUTION FOR YOUR SITE



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APPENDIX B

List of MCLs and RLs

Appendix B. List of MDLs and RLs for Soil and Groundwater				
Analyte Description	CAS Number	RL	MDL	Units
Volatile Organic Compounds (GC/MS) 8260 Groundwater				
1,1,1-Trichloroethane	71-55-6	1.00	0.180	ug/L
1,1,2,2-Tetrachloroethane	79-34-5	1.00	0.500	ug/L
1,1,2-Trichloroethane	79-00-5	1.00	0.210	ug/L
1,1,2-Trichlorotrifluoroethane	76-13-1	3.00	0.500	ug/L
1,1-Dichloroethane	75-34-3	1.00	0.500	ug/L
1,1-Dichloroethene	75-35-4	1.00	0.500	ug/L
1,2,3-Trichlorobenzene	87-61-6	1.00	0.900	ug/L
1,2,4-Trichlorobenzene	120-82-1	1.00	0.820	ug/L
1,2-Dibromo-3-Chloropropane	96-12-8	5.00	1.50	ug/L
1,2-Dibromoethane	106-93-4	1.00	0.230	ug/L
1,2-Dichlorobenzene	95-50-1	1.00	0.500	ug/L
1,2-Dichloroethane	107-06-2	1.00	0.190	ug/L
1,2-Dichloropropane	78-87-5	1.00	0.500	ug/L
1,3-Dichlorobenzene	541-73-1	1.00	0.540	ug/L
1,4-Dichlorobenzene	106-46-7	1.00	0.640	ug/L
1,4-Dioxane	123-91-1	200	200	ug/L
2-Butanone (MEK)	78-93-3	6.00	2.60	ug/L
2-Hexanone	591-78-6	5.00	1.40	ug/L
4-Methyl-2-pentanone (MIBK)	108-10-1	5.00	1.80	ug/L
Acetone	67-64-1	10.0	10.0	ug/L
Benzene	71-43-2	1.00	0.130	ug/L
Bromoform	75-25-2	1.00	0.250	ug/L
Bromomethane	74-83-9	2.00	0.980	ug/L
Carbon disulfide	75-15-0	2.00	0.500	ug/L
Carbon tetrachloride	56-23-5	1.00	0.190	ug/L
Chlorobenzene	108-90-7	1.00	0.150	ug/L
Chlorobromomethane	74-97-5	1.00	0.210	ug/L
Chlorodibromomethane	124-48-1	1.00	0.240	ug/L
Chloroethane	75-00-3	2.00	0.760	ug/L
Chloroform	67-66-3	1.00	1.00	ug/L
Chloromethane	74-87-3	2.00	0.320	ug/L
cis-1,2-Dichloroethene	156-59-2	1.00	0.200	ug/L
cis-1,3-Dichloropropene	10061-01-5	1.00	0.500	ug/L
Cyclohexane	110-82-7	2.00	0.500	ug/L
Dichlorobromomethane	75-27-4	1.00	0.500	ug/L
Dichlorodifluoromethane	75-71-8	2.00	0.850	ug/L
Ethylbenzene	100-41-4	1.00	0.500	ug/L
Isopropylbenzene	98-82-8	1.00	0.530	ug/L
Methyl acetate	79-20-9	5.00	0.610	ug/L
Methyl tert-butyl ether	1634-04-4	5.00	0.220	ug/L
Methylcyclohexane	108-87-2	1.00	0.500	ug/L
Methylene Chloride	75-09-2	2.00	3.00	ug/L
m-Xylene & p-Xylene	179601-23-1	2.00	0.630	ug/L
o-Xylene	95-47-6	1.00	0.600	ug/L
Styrene	100-42-5	1.00	1.00	ug/L
Tetrachloroethene	127-18-4	1.00	0.900	ug/L
Toluene	108-88-3	1.00	0.410	ug/L
trans-1,2-Dichloroethene	156-60-5	1.00	0.500	ug/L

Appendix B. List of MDLs and RLs for Soil and Groundwater				
Analyte Description	CAS Number	RL	MDL	Units
trans-1,3-Dichloropropene	10061-02-6	3.00	0.200	ug/L
Trichloroethene	79-01-6	1.00	0.150	ug/L
Trichlorofluoromethane	75-69-4	2.00	0.520	ug/L
Vinyl chloride	75-01-4	1.00	0.500	ug/L
Toluene-d8 (Surr)	2037-26-5	2.00		ug/L
4-Bromofluorobenzene	460-00-4			ug/L
Dibromofluoromethane	1868-53-7			ug/L
Semivolatile Organic Compounds (GC/MS) 8270D Groundwater				
1,2,4-Trichlorobenzene	120-82-1	10.0	8.50	ug/L
1,2-Dichlorobenzene	95-50-1	10.0	7.30	ug/L
1,3-Dichlorobenzene	541-73-1	10.0	3.90	ug/L
1,4-Dichlorobenzene	106-46-7	10.0	6.20	ug/L
1,4-Dioxane	123-91-1	10.0	4.30	ug/L
2,2'-oxybis[1-chloropropane]	108-60-1	10.0	1.80	ug/L
2,4,5-Trichlorophenol	95-95-4	10.0	4.00	ug/L
2,4,6-Trichlorophenol	88-06-2	10.0	3.50	ug/L
2,4-Dichlorophenol	120-83-2	10.0	4.30	ug/L
2,4-Dimethylphenol	105-67-9	10.0	5.20	ug/L
2,4-Dinitrophenol	51-28-5	30.0	4.60	ug/L
2,4-Dinitrotoluene	121-14-2	10.0	5.10	ug/L
2-Chloronaphthalene	91-58-7	10.0	3.80	ug/L
2-Chlorophenol	95-57-8	10.0	4.10	ug/L
2-Methylnaphthalene	91-57-6	10.0	4.60	ug/L
2-Methylphenol	95-48-7	10.0	6.90	ug/L
2-Nitroaniline	88-74-4	10.0	5.00	ug/L
2-Nitrophenol	88-75-5	10.0	4.60	ug/L
3 & 4 Methylphenol	15831-10-4	20.0	4.60	ug/L
3,3'-Dichlorobenzidine	91-94-1	11.0	11.0	ug/L
3-Nitroaniline	99-09-2	10.0	4.70	ug/L
4,6-Dinitro-2-methylphenol	534-52-1	10.0	10.0	ug/L
4-Bromophenyl phenyl ether	101-55-3	10.0	8.60	ug/L
4-Chloro-3-methylphenol	59-50-7	10.0	5.30	ug/L
4-Chloroaniline	106-47-8	10.0	4.70	ug/L
4-Chlorophenyl phenyl ether	7005-72-3	10.0	8.50	ug/L
4-Nitroaniline	100-01-6	10.0	4.10	ug/L
4-Nitrophenol	100-02-7	10.0	3.30	ug/L
Acenaphthene	83-32-9	10.0	4.40	ug/L
Acenaphthylene	208-96-8	10.0	4.10	ug/L
Acetophenone	98-86-2	10.0	5.10	ug/L
Anthracene	120-12-7	10.0	3.90	ug/L
Benzo[a]anthracene	56-55-3	10.0	6.60	ug/L
Benzo[a]pyrene	50-32-8	10.0	6.20	ug/L
Benzo[b]fluoranthene	205-99-2	10.0	5.20	ug/L
Benzo[g,h,i]perylene	191-24-2	10.0	3.10	ug/L
Benzo[k]fluoranthene	207-08-9	10.0	8.10	ug/L
Benzyl alcohol	100-51-6	10.0	7.30	ug/L
Bis(2-chloroethoxy)methane	111-91-1	10.0	4.60	ug/L
Bis(2-chloroethyl)ether	111-44-4	10.0	3.90	ug/L
Bis(2-ethylhexyl) phthalate	117-81-7	10.0	8.90	ug/L

Appendix B. List of MDLs and RLs for Soil and Groundwater				
Analyte Description	CAS Number	RL	MDL	Units
Butyl benzyl phthalate	85-68-7	10.0	5.80	ug/L
Carbazole	86-74-8	10.0	5.00	ug/L
Chrysene	218-01-9	10.0	6.40	ug/L
Dibenz(a,h)anthracene	53-70-3	10.0	2.70	ug/L
Dibenzofuran	132-64-9	10.0	4.00	ug/L
Diethyl phthalate	84-66-2	10.0	4.40	ug/L
Dimethyl phthalate	131-11-3	10.0	4.20	ug/L
Di-n-butyl phthalate	84-74-2	10.0	4.60	ug/L
Di-n-octyl phthalate	117-84-0	10.0	6.00	ug/L
Fluoranthene	206-44-0	10.0	4.10	ug/L
Fluorene	86-73-7	10.0	4.70	ug/L
Hexachlorobenzene	118-74-1	10.0	9.70	ug/L
Hexachlorobutadiene	87-68-3	10.0	1.70	ug/L
Hexachlorocyclopentadiene	77-47-4	20.0	4.50	ug/L
Hexachloroethane	67-72-1	10.0	5.20	ug/L
Indeno[1,2,3-cd]pyrene	193-39-5	10.0	2.90	ug/L
Isophorone	78-59-1	10.0	5.20	ug/L
Naphthalene	91-20-3	10.0	4.00	ug/L
Nitrobenzene	98-95-3	10.0	4.70	ug/L
N-Nitrosodi-n-propylamine	621-64-7	10.0	5.60	ug/L
N-Nitrosodiphenylamine	86-30-6	10.0	3.70	ug/L
Pentachlorophenol	87-86-5	20.0	11.9	ug/L
Phenanthrene	85-01-8	10.0	7.60	ug/L
Phenol	108-95-2	10.0	4.20	ug/L
Pyrene	129-00-0	10.0	3.90	ug/L
2,4,6-Tribromophenol (Surr)	118-79-6			ug/L
2-Fluorobiphenyl	321-60-8			ug/L
2-Fluorophenol (Surr)	367-12-4			ug/L
Nitrobenzene-d5 (Surr)	4165-60-0			ug/L
Phenol-d5 (Surr)	4165-62-2			ug/L
Terphenyl-d14 (Surr)	1718-51-0			ug/L
Volatile Organic Compounds by GC/MS 8260C Soil				
Acetone	67-64-1	25.0	12.0	ug/Kg
Benzene	71-43-2	5.00	0.670	ug/Kg
Chlorobromomethane	74-97-5	5.00	0.810	ug/Kg
Dichlorobromomethane	75-27-4	5.00	0.920	ug/Kg
Bromoform	75-25-2	5.00	1.30	ug/Kg
Bromomethane	74-83-9	5.00	2.50	ug/Kg
2-Butanone (MEK)	78-93-3	25.0	6.00	ug/Kg
Carbon disulfide	75-15-0	5.00	0.660	ug/Kg
Carbon tetrachloride	56-23-5	5.00	1.70	ug/Kg
Chlorobenzene	108-90-7	5.00	0.520	ug/Kg
Chlorodibromomethane	124-48-1	5.00	1.20	ug/Kg
Chloroethane	75-00-3	5.00	1.20	ug/Kg
Chloroform	67-66-3	5.00	5.00	ug/Kg
Chloromethane	74-87-3	5.00	1.00	ug/Kg
Cyclohexane	110-82-7	5.00	0.940	ug/Kg
1,2-Dibromo-3-Chloropropane	96-12-8	5.00	3.30	ug/Kg
1,2-Dichlorobenzene	95-50-1	5.00	0.710	ug/Kg

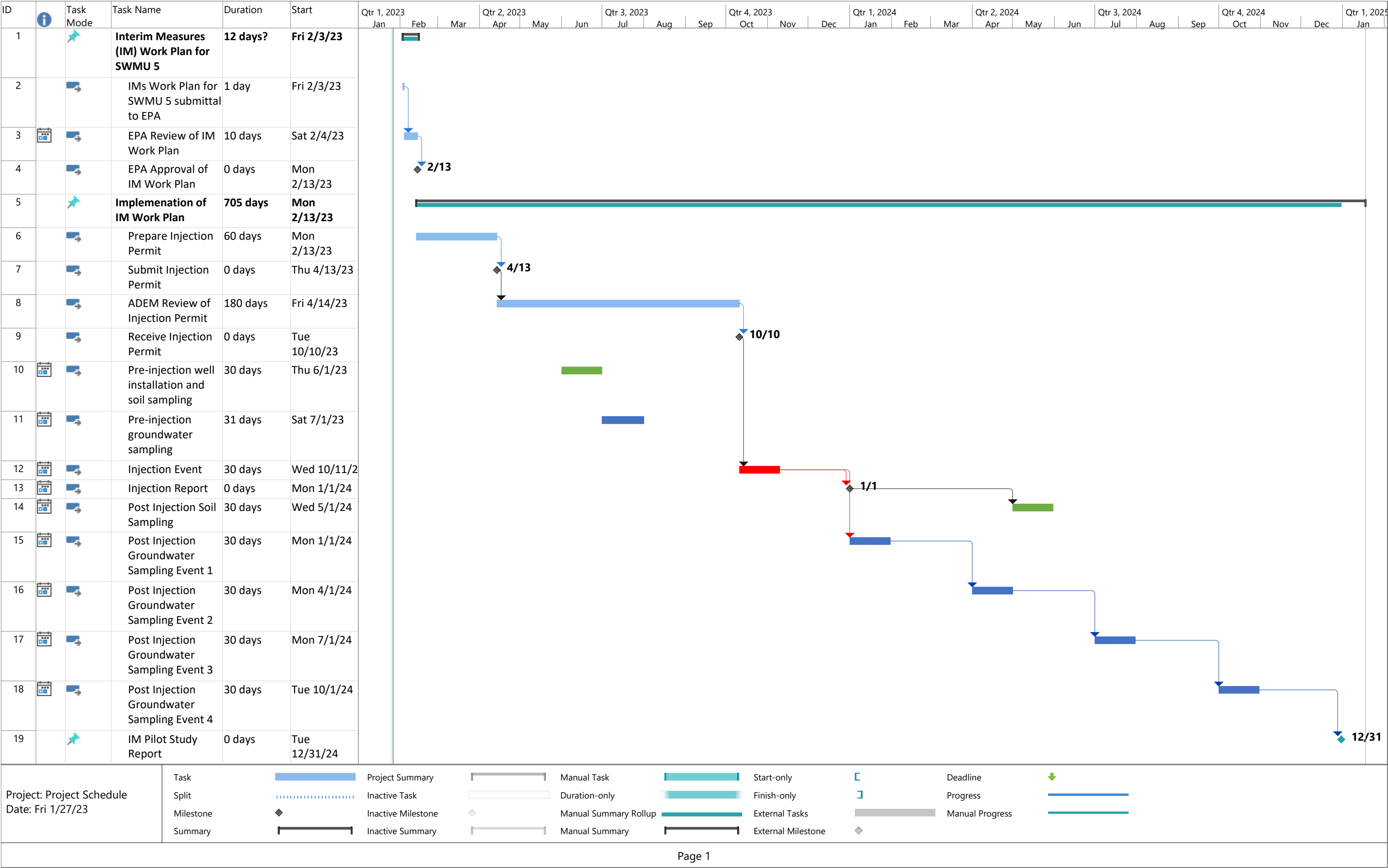
Appendix B. List of MDLs and RLs for Soil and Groundwater				
Analyte Description	CAS Number	RL	MDL	Units
1,3-Dichlorobenzene	541-73-1	5.00	0.950	ug/Kg
1,4-Dichlorobenzene	106-46-7	5.00	0.860	ug/Kg
Dichlorodifluoromethane	75-71-8	5.00	1.30	ug/Kg
1,1-Dichloroethane	75-34-3	5.00	0.830	ug/Kg
1,2-Dichloroethane	107-06-2	5.00	0.820	ug/Kg
cis-1,2-Dichloroethene	156-59-2	5.00	0.760	ug/Kg
trans-1,2-Dichloroethene	156-60-5	5.00	0.960	ug/Kg
1,1-Dichloroethene	75-35-4	5.00	0.850	ug/Kg
1,2-Dichloropropane	78-87-5	5.00	0.760	ug/Kg
cis-1,3-Dichloropropene	10061-01-5	5.00	1.20	ug/Kg
trans-1,3-Dichloropropene	10061-02-6	5.00	1.10	ug/Kg
1,4-Dioxane	123-91-1	500	50.0	ug/Kg
Ethylbenzene	100-41-4	5.00	0.610	ug/Kg
2-Hexanone	591-78-6	25.0	5.00	ug/Kg
Isopropylbenzene	98-82-8	5.00	0.680	ug/Kg
Methyl acetate	79-20-9	5.00	4.60	ug/Kg
Methylcyclohexane	108-87-2	5.00	0.590	ug/Kg
Methylene Chloride	75-09-2	15.0	10.0	ug/Kg
4-Methyl-2-pentanone (MIBK)	108-10-1	25.0	5.00	ug/Kg
Methyl tert-butyl ether	1634-04-4	5.00	1.00	ug/Kg
Styrene	100-42-5	5.00	1.00	ug/Kg
1,1,2,2-Tetrachloroethane	79-34-5	5.00	0.820	ug/Kg
Tetrachloroethene	127-18-4	5.00	3.00	ug/Kg
Toluene	108-88-3	5.00	1.00	ug/Kg
1,2,3-Trichlorobenzene	87-61-6	5.00	1.10	ug/Kg
1,2,4-Trichlorobenzene	120-82-1	5.00	0.920	ug/Kg
1,1,1-Trichloroethane	71-55-6	5.00	1.10	ug/Kg
1,1,2-Trichloroethane	79-00-5	5.00	0.780	ug/Kg
Trichloroethene	79-01-6	5.00	1.00	ug/Kg
Trichlorofluoromethane	75-69-4	5.00	0.860	ug/Kg
1,1,2-Trichlorotrifluoroethane	76-13-1	5.00	0.840	ug/Kg
Vinyl chloride	75-01-4	5.00	0.800	ug/Kg
m-Xylene & p-Xylene	179601-23-1	5.00	1.30	ug/Kg
o-Xylene	95-47-6	5.00	1.00	ug/Kg
1,2-Dibromoethane	106-93-4	5.00	1.00	ug/Kg
4-Bromofluorobenzene	460-00-4			ug/Kg
Dibromofluoromethane	1868-53-7			ug/Kg
Toluene-d8 (Surr)	2037-26-5			ug/Kg
Semivolatile Organic Compounds (GC/MS) 8270D Soil				
1,2,4-Trichlorobenzene	120-82-1	330	33.0	ug/Kg
1,2-Dichlorobenzene	95-50-1	330	33.0	ug/Kg
1,3-Dichlorobenzene	541-73-1	330	33.0	ug/Kg
1,4-Dichlorobenzene	106-46-7	330	33.0	ug/Kg
1,4-Dioxane	123-91-1	330	33.0	ug/Kg
2,2'-oxybis[1-chloropropane]	108-60-1	330	33.0	ug/Kg
2,3,4,6-Tetrachlorophenol	58-90-2	330	33.0	ug/Kg
2,4,5-Trichlorophenol	95-95-4	330	33.0	ug/Kg
2,4,6-Trichlorophenol	88-06-2	330	33.0	ug/Kg
2,4-Dichlorophenol	120-83-2	330	33.0	ug/Kg

Appendix B. List of MDLs and RLs for Soil and Groundwater				
Analyte Description	CAS Number	RL	MDL	Units
2,4-Dimethylphenol	105-67-9	330	33.0	ug/Kg
2,4-Dinitrophenol	51-28-5	990	290	ug/Kg
2,4-Dinitrotoluene	121-14-2	330	33.0	ug/Kg
2-Chloronaphthalene	91-58-7	330	33.0	ug/Kg
2-Chlorophenol	95-57-8	330	33.0	ug/Kg
2-Methylnaphthalene	91-57-6	330	33.0	ug/Kg
2-Methylphenol	95-48-7	330	80.0	ug/Kg
2-Nitroaniline	88-74-4	330	70.0	ug/Kg
2-Nitrophenol	88-75-5	330	33.0	ug/Kg
3 & 4 Methylphenol	15831-10-4	660	33.0	ug/Kg
3,3'-Dichlorobenzidine	91-94-1	330	33.0	ug/Kg
3-Nitroaniline	99-09-2	330	78.0	ug/Kg
4,6-Dinitro-2-methylphenol	534-52-1	330	33.0	ug/Kg
4-Bromophenyl phenyl ether	101-55-3	330	33.0	ug/Kg
4-Chloro-3-methylphenol	59-50-7	330	81.0	ug/Kg
4-Chloroaniline	106-47-8	330	33.0	ug/Kg
4-Chlorophenyl phenyl ether	7005-72-3	330	33.0	ug/Kg
4-Nitroaniline	100-01-6	330	113	ug/Kg
4-Nitrophenol	100-02-7	330	110	ug/Kg
Acenaphthene	83-32-9	330	33.0	ug/Kg
Acenaphthylene	208-96-8	330	33.0	ug/Kg
Acetophenone	98-86-2	330	33.0	ug/Kg
Anthracene	120-12-7	330	33.0	ug/Kg
Benzo[a]anthracene	56-55-3	330	33.0	ug/Kg
Benzo[a]pyrene	50-32-8	330	33.0	ug/Kg
Benzo[b]fluoranthene	205-99-2	330	33.0	ug/Kg
Benzo[g,h,i]perylene	191-24-2	330	33.0	ug/Kg
Benzo[k]fluoranthene	207-08-9	330	33.0	ug/Kg
Benzyl alcohol	100-51-6	330	110	ug/Kg
Bis(2-chloroethoxy)methane	111-91-1	330	33.0	ug/Kg
Bis(2-chloroethyl)ether	111-44-4	330	92.0	ug/Kg
Bis(2-ethylhexyl) phthalate	117-81-7	330	81.0	ug/Kg
Butyl benzyl phthalate	85-68-7	330	71.0	ug/Kg
Carbazole	86-74-8	330	33.0	ug/Kg
Chrysene	218-01-9	330	33.0	ug/Kg
Dibenz(a,h)anthracene	53-70-3	330	33.0	ug/Kg
Dibenzofuran	132-64-9	330	33.0	ug/Kg
Diethyl phthalate	84-66-2	330	33.0	ug/Kg
Dimethyl phthalate	131-11-3	330	33.0	ug/Kg
Di-n-butyl phthalate	84-74-2	330	33.0	ug/Kg
Di-n-octyl phthalate	117-84-0	330	120	ug/Kg
Fluoranthene	206-44-0	330	33.0	ug/Kg
Fluorene	86-73-7	330	33.0	ug/Kg
Hexachlorobenzene	118-74-1	330	100	ug/Kg
Hexachlorobutadiene	87-68-3	330	33.0	ug/Kg
Hexachlorocyclopentadiene	77-47-4	330	66.0	ug/Kg
Hexachloroethane	67-72-1	330	31.0	ug/Kg
Indeno[1,2,3-cd]pyrene	193-39-5	330	33.0	ug/Kg
Isophorone	78-59-1	330	33.0	ug/Kg

Appendix B. List of MDLs and RLs for Soil and Groundwater				
Analyte Description	CAS Number	RL	MDL	Units
Naphthalene	91-20-3	330	33.0	ug/Kg
Nitrobenzene	98-95-3	330	33.0	ug/Kg
N-Nitrosodi-n-propylamine	621-64-7	330	38.0	ug/Kg
N-Nitrosodiphenylamine	86-30-6	330	33.0	ug/Kg
Pentachlorophenol	87-86-5	660	66.0	ug/Kg
Phenanthrene	85-01-8	330	33.0	ug/Kg
Phenol	108-95-2	330	33.0	ug/Kg
Pyrene	129-00-0	330	33.0	ug/Kg
2,4,6-Tribromophenol (Surr)	118-79-6	330	330	ug/Kg
2-Fluorobiphenyl	321-60-8	330	330	ug/Kg
2-Fluorophenol (Surr)	367-12-4	330	330	ug/Kg
Nitrobenzene-d5 (Surr)	4165-60-0	330	330	ug/Kg
Phenol-d5 (Surr)	4165-62-2	330	330	ug/Kg
Terphenyl-d14 (Surr)	1718-51-0	330	330	ug/Kg

APPENDIX C

Project Timeline

Start-onlyFinish-onlyExternal TasksExternal MilestoneDeadlineProgressManual Progress

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